



Study on spatio temporal changes of land use pattern in Contai municipality of Purba Medinipur district West Bengal

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Abstract

The land use/land cover pattern of any region is an outcome of various physical and cultural factors and their utilisation by man in time and space. In general the term “land use” refers to the human activity of economical function associated with specific geography. Land cover as a type of natural features present on the surface of the earth. It is widely recognised that study area of land use/land cover change phenomena at local regional and global level is crucial for understanding the negative impacts on environment, which include impact on climate, water resource, soil, vegetation etc. As a result of the growing impacts it has become important for land use planners to extract, detect, monitor and predict land use/cover changes (LUCCs). The monitoring of LUCCs within a certain time period and predicting future trends of temporal and spatial changes are absolutely necessary. The aim of this study is to analyze and monitor LUCCs at Contai town over a time span of 10 years and predict the future trend of changes during the period of 2009–2019. Land use/cover (LULC) maps were extracted via RS images obtained from Land sat TM, ETM+ and OLI, respectively.

Keywords: image processing, image enhancement, terrain features, vegetation index, land cover

Introduction

Up-to-date, adequate and reliable LUCCs information from the past to present together with the future plausible changes is vital to understand and evaluate several social, economic and environmental consequences of these changes. The proper understanding of the influence of the various human induced land use practices with regard to the environmental change is also essential as it helps to simulate the changes. The knowledge is also essential for deriving an appropriate developmental plan, which also address the impeding issues like uncontrolled development, deteriorating environmental quality, loss of prime agricultural lands, destruction of importance wet lands and loss of natural habitat etc. land use land cover as well as the capability to monitor the dynamics of land use resulting out of changing demands of increasing population.

Objective of the Study

The main objectives of the present study are i) to provide multi-temporal land use information using RS techniques integrated with geographic information systems (GIS) for better analyzing and monitoring LUCC, ii) to assess and understand the present land use pattern of Contai municipality and the associated problems evolved with these changes, iii) to predict the future distribution and configuration of the land use types and explore the process of the changes. Understanding such changes can play a critical role in formulating effective policies and management strategies in the study area and the surrounding region. So, the regional and local managers, planners and policy makers can step up towards sustainable development with adequate and up-to-date information.

Database and Methodology

In order to use satellite images of different periods, considering the suitability of cloud-free spatial coverage, relatively high spatial and spectral resolution and same image date-acquired for the year (especially the same plant growing seasons) are essential. Based on these criteria, relevant literature review and the wide range application of Land sat images for land use studies, RS images of Land sat satellites have been used to investigate the long term land use changes in the study area (table no-1).

Table 1: RS images of Land sat satellites used to investigate the land use changes in the study area

| Satellite image | Year | Spatial Resolution | Path & Row | Date of acquisition |
|-----------------|------|--------------------|------------|---------------------|
| LANDSAT 5 TM | 2009 | 30m*30m | 138/45 | 03.02.2009 |
| LANDSAT 8 OLI | 2019 | 30m*30m | 138/45 | 30.11.2019 |

The methods are used to identify the temporal changes of the land use pattern of the study area are Image processing, Image enhancement, Supervised image classification, NDVI etc.

Location of the Study Area

Contai is basically a town originated with administrative functions and the oldest municipality in Purba Medinipur District, West Bengal, India. According to the geologists, the present geographical dimension of Contai has formally come into existence with the great natural disaster of the third century AD which created Chilka Lake out of the Chilka bay. Kanthi, that is Contai, means “sand-bound reefs or sand walls. The name Contai may thus be English expression of the local jargon meaning “sand heaps”. Latitude and Longitude coordinates of Contai Municipality area are 21° 46’ 45” N and 87° 04’ 40” E. Contai is a small city with the area of 17.25 Sq.Km. It is the headquarters of the Contai sub-division. The elevation of Contai Municipality is 6 m. Contai is situated about 31 Km. from the beach town Digha and 160 km. from Kolkata.

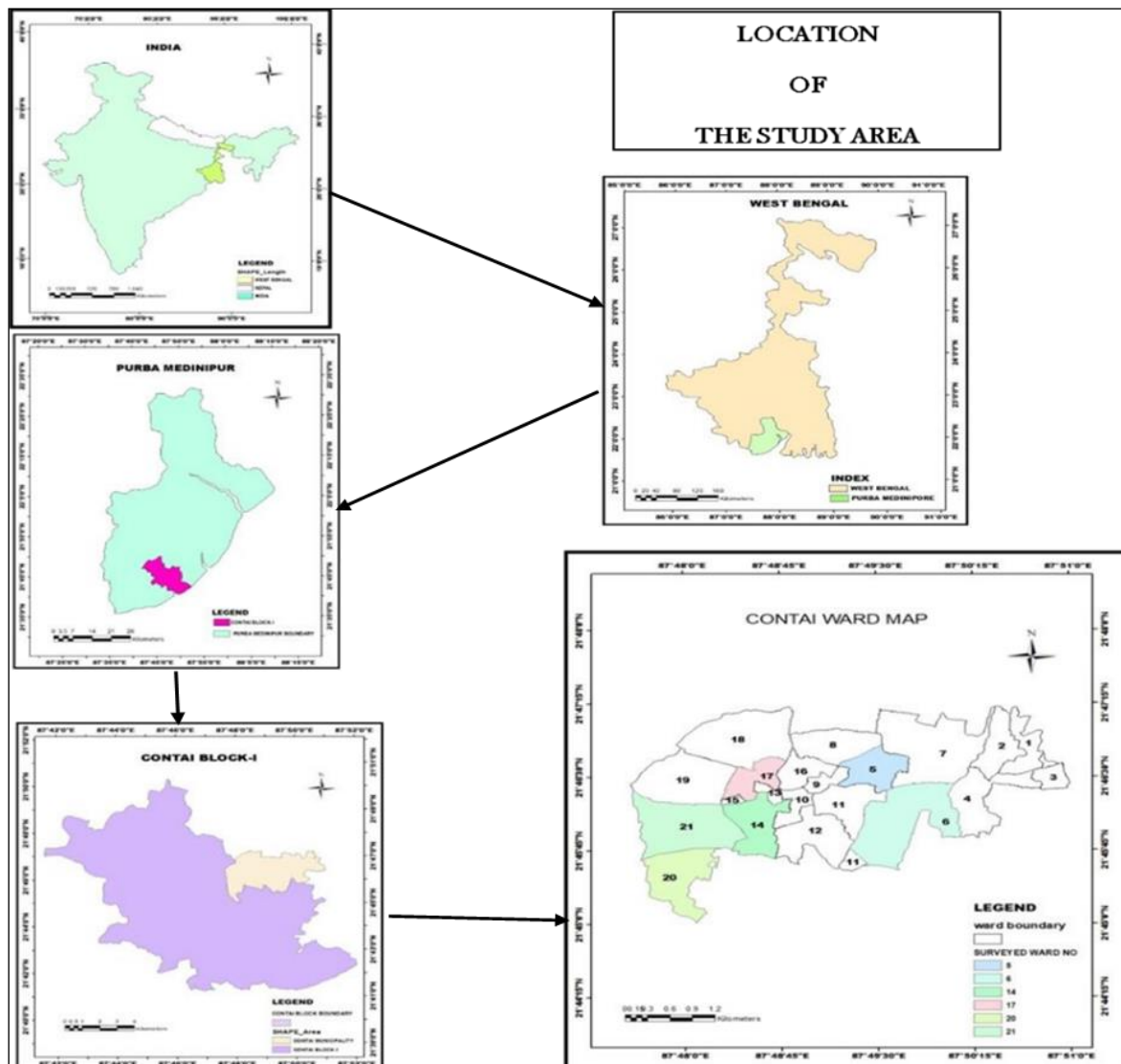


Fig 1: Location of the Study Area.

Results and Discussion

Land use and Land cover therefore from a major determinant in spatial planning. The entire process of planning is focused finally at preservation or regulated changes made in land use of the constituent parcel of land in the area for which planning initiated. In order to get the trend of land-use changes, 10 years period has been taken in to consideration according to the limitations in selection of satellite images and LULC maps extracted for 2009 and 2019.

Table 2: Partitioning (mtr.) of Contai Municipality into LULC types in each of the studied years.

| LULC type | Year | |
|-----------|-------|-------|
| | 2009 | 2019 |
| A | 42759 | 3393 |
| B | 59517 | 80244 |

| | | |
|---|-------|-------|
| V | 25218 | 14553 |
| W | 88200 | 62200 |

*A= Agricultural land, B =Built-up area (also expresses as human built environment or urban area in this paper), V= Vegetation cover, W= Water body

Data collected from 2009 & 2019 Satellite images reveal that Land uses Land cover classes of water bodies were 88200 mtr. in 2009 and 62200 mtr. in 2019. The vegetation cover was 25218 mtr in 2009 and 14553 mtr. in 2019, similarly agricultural land was 42759 mtr. in 2009 which changed in 2019 to 33930 mtr. Built- up area was 59517 mtr. in 2009 but it changed in 2019 to 80244 mtr. In the study it has been confirmed that the effect of urbanization is very prominent in Land use changes particularly rapid expansion of urban settlement in the municipality area. The change in land use affects the ecosystem in terms of land cover, land quality and capability, weather and climate, quantity of land that can be sustained in short the whole population and socio-economic determinants.

The land use and land cover changes have been discussed in terms of two selected years having 10 years interval 2009 and 2019. Table -2 and Figure- 2 show that within the time period of 2009 and 2019, the agricultural land coverage has been reduced from 24.43% to 22.47%, while during 2009 to 2019, the share of urban area has been increased from 0.857% in 2009 to 2.22% in 2019 in the study area, suggesting an ascending trend in the development of urban areas.

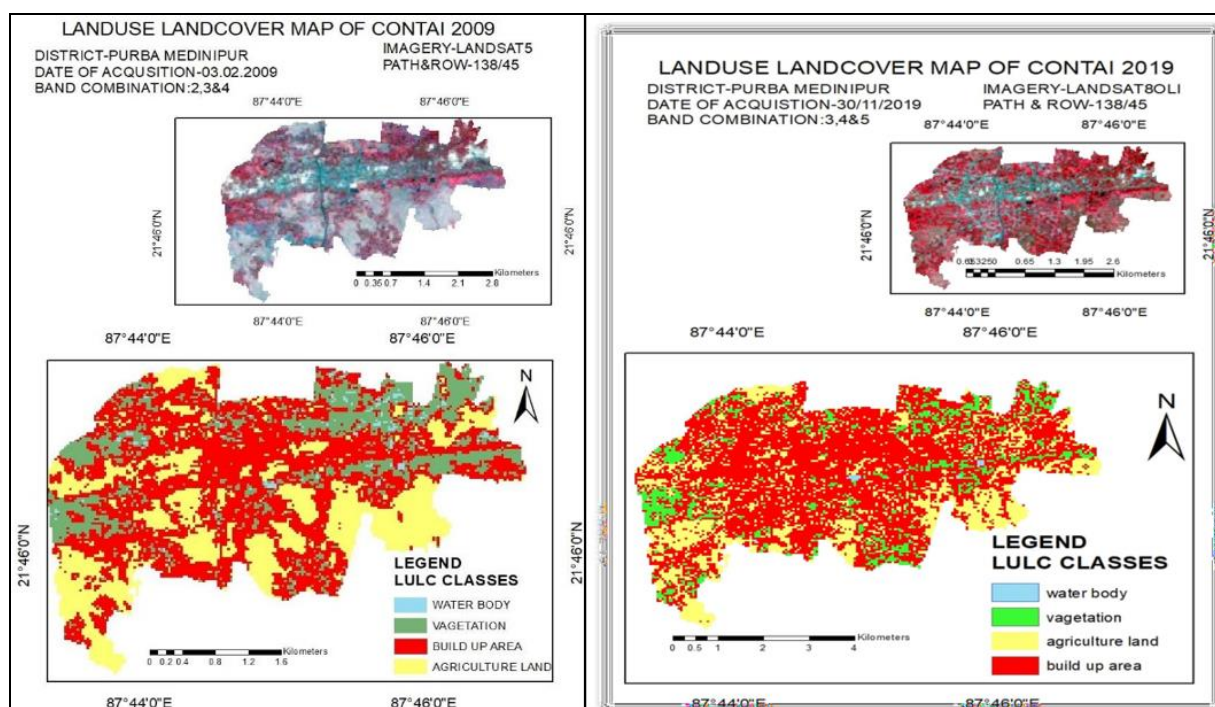


Fig 2: Land use land cover Map of Contai Municipality- 2009, 2019.

Major Findings

From the analysis of land use land cover maps of Contai municipality the following facts have been identified:-

- The changing land use pattern of Contai municipal area depicts that the agricultural land, vegetation cover and water bodies within the municipal boundary are decreasing at a very rapid rate. On the other hand, the built- up area is the only land cover type which is increasing very rapidly. It reveals the fact that the land is unable to maintain a planned urban growth and in near future shortage of open space will make the city a concrete jungle.
- The NDVI of the two decades reveal that the spatial coverage as well as the quality of vegetation is extremely poor. The value is near 0.3 which indicates the presence of poor quality vegetation. The spatial coverage is decreasing with time and fast expansion of the built up areas.
- The water index for two decades is also giving a similar kind of picture. Expansion of built up area also affects the water bodies in the study area and the value is very low in case of both the decades.

Conclusion

Overall, it can be stated that with the expansion of human settlement (resulting from various factors, especially rapid growth of population), the agricultural land has also had an incremental trend, which is quite natural. Because, as residential areas expand and increase, the urban need for resources (that is, ecological footprint) grows, which require further fertile lands to meet these needs. This growth of urban areas and in turn increase in agricultural lands has resulted to the decrease in bare lands.

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