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LAND USE AND LAND COVER CHANGE DETECTION STUDY AT INDIAN SUNDARBAN DELTA USING REMOTE SENSING AND GIS

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ABSTRACT

The present research work is essential job for the populated part of the Indian Sundarban, because of very active estuarine and sedimentary process operated this area rapidly and active delta building operation is also operating here very rigorously. Beside this, very high pressure of population throughout the GBD (Ganga Brahamaputra Delta), influence the whole set up of LULC. In this regards application of Geoinformatics in LULC classification will be only proper way out for this operation. The major objectives of our study to find out the a complete land use and land cover map during 1973 - 2014, and identify the major problems of the study area and suggest the suitable recommendations through literature survey, application of remote sensing, interpretation of satellite data through ERDAS and ArcGIS Software. Remote sensing and GIS have covered wide range of applications in the fields of agriculture, environments, and integrated eco-environment assessment. Several researchers have focused on LU/LC studies because of their adverse effects on ecology of the area and vegetation. Present study area witnesses a change in the years 1973, 1989, 2000 & 2014 due to population increase substantially.

Introduction

The present research work is concerned with the land use and land cover change detection study at Indian Sundarban delta using remote sensing and GIS. Sundarban is the largest delta in the world. The Sundarban lies in the vast delta on the Bay of Bengal formed by the super confluence of the Padma, Brahmaputra and Meghna rivers. The forest covers 10,000 square kilometers (3,900 sq. mi) of which about 6,000 square kilometers (2,300 sq. mi) are in Bangladesh and The Indian part of Sundarban is estimated to be about 4,110 square

kilometers (1,590 sq mi), of which about 1,700 square kilometers (660 sq. mi) is occupied by water bodies in the forms of river, canals and creeks of width varying from a few meters to several kilometers and islands which total about 102 in number of these 54 islands are inhabited and the rest 48 islands are forested. The name Sundarban is thought to be derived from the Sundari(Heritierafomes) tree. Another view is that the name comes from the Sundarban meaning a beautiful forest. This part of the GBM delta as we see it today came to be formed between 2500 and 5000 years ago by the silt carried by the river Ganges (Allison et al, 2003) as well as its tributaries like Mayurakshi, Damodar, Ajay, and Kansai rivers. It is part of the tide dominated lower deltaic plain.

Location:

Sundarban delta is the part of Ganga, Brahmaputra and Meghna. The sundarban is a stretch of largely impenetrable mangrove forest laying the southern part of west Bengal, India. Extending about 350 km along with the Bay of Bengal from the Hooghly river estuary. The Indian Sundarban lies between 21˚40'04"N and 22˚09'21"N latitude, and 88˚01'56"E and 89˚06'01"E longitude. The average altitude of the park is 7.5 m above sea level. The present researchworks have selected total part of Indian Sundarban area. The Indian Sundarban Delta is bounded by the IchamatiRaimangal River in the east, by the Hooghly River in the west, by the Bay of Bengal in the south, and the Dampier Hodges line drawn in 1829-1830 in the north (Fig-1).

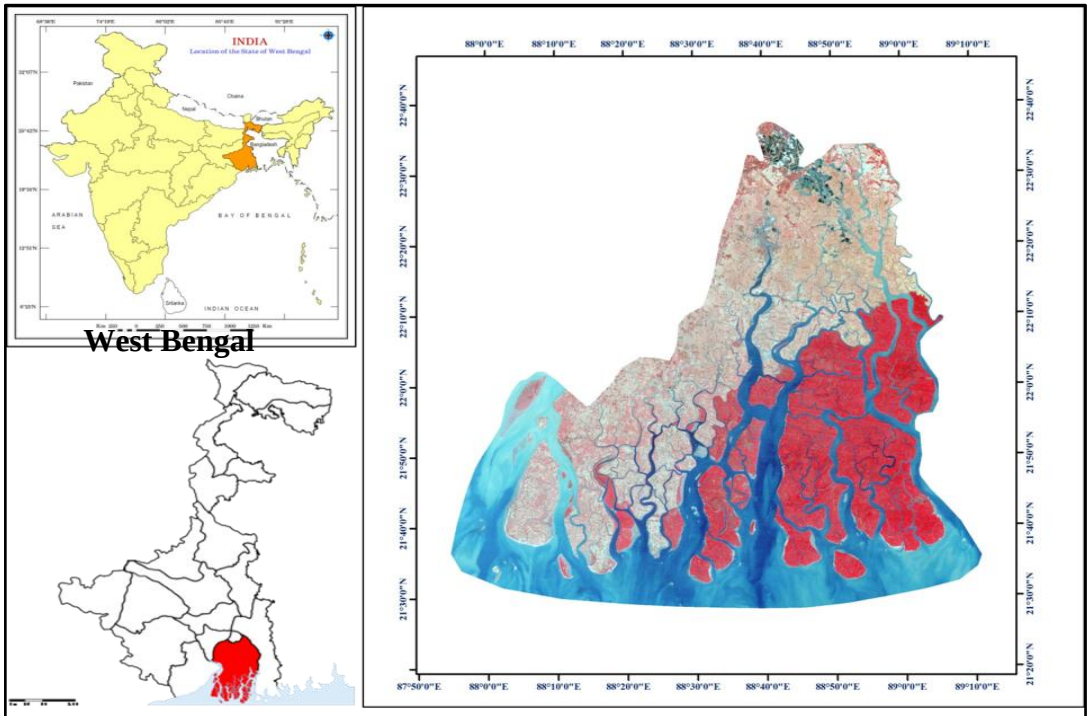

Fig –1, Location of Study Area.

Study Area
Sundarban Islands

OBJECTIVES

The prime objectives of present research are to be delineating the land use transfiguration scenario in relation to environment- development strategy of the ISD. This also discloses the land use deviation, changing socio-economic features and environmental issues.

Materials and Methods

It is the systematic analysis Multi-temporal and moderate to high resolution data have been used for this particular study. Here the US Geological Survey (USGS) Landsat 1 MSS, Landsat 5 Thermal Mapper (TM) data, Landsat 8 OLI_TIRS, and topographical sheets (scale: 1: 50,000; year: 1917) have been used for this study. Through Arc GIS 10 software, ERDAS Imagine 9.1 software, after band wise conversion of the quantised and calibrated scaled digital number (DN), known as DN value of the bands, to top of atmosphere (TOA) radiance value, unsupervised classification of the study have made. Information and data processing, preparation of standard information, preparation of maps, and preparation a final result, the entire investigation and findings have been done through a systematic way.

Land useLand cover and Change Detection study

Using of Remote sensing and GIS technology this Spatio- temporal analysis was done.The study of land use land cover (LU/LC) changes is very important to proper planning and utilization of natural resources and their management. As Albert Guttenberg (1959) wrote, Land use is a key term language of city planning. So, knowledge of current land use is needed for formulating changes leading to sustainable use of the land resources. Land use is characterized by the arrangements, activities and inputs people undertake in certain land cover type to produce, change or maintain it.

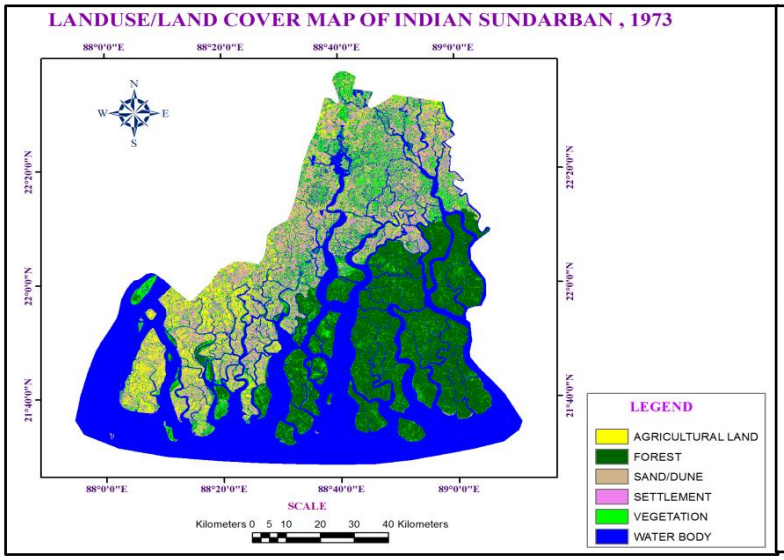

Fig.2,LanduseLandcovermapofSundarb an in 1973

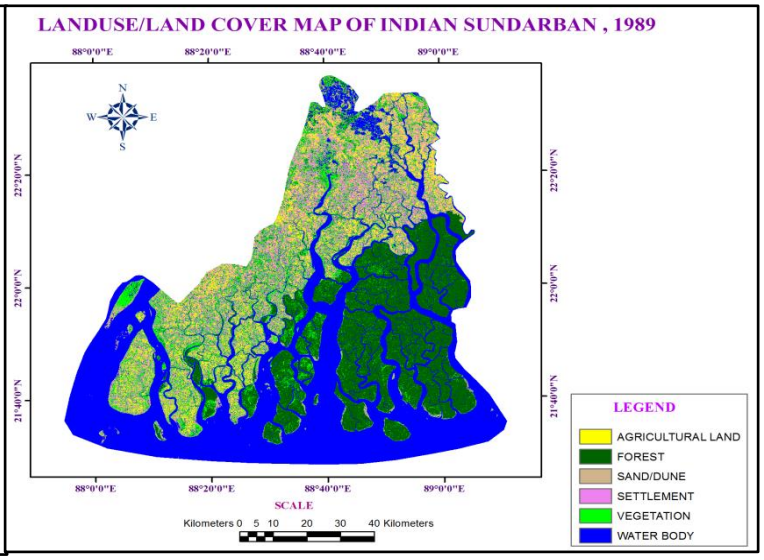

Fig. - 3,Land use Land cover map of Sundarban in 1989

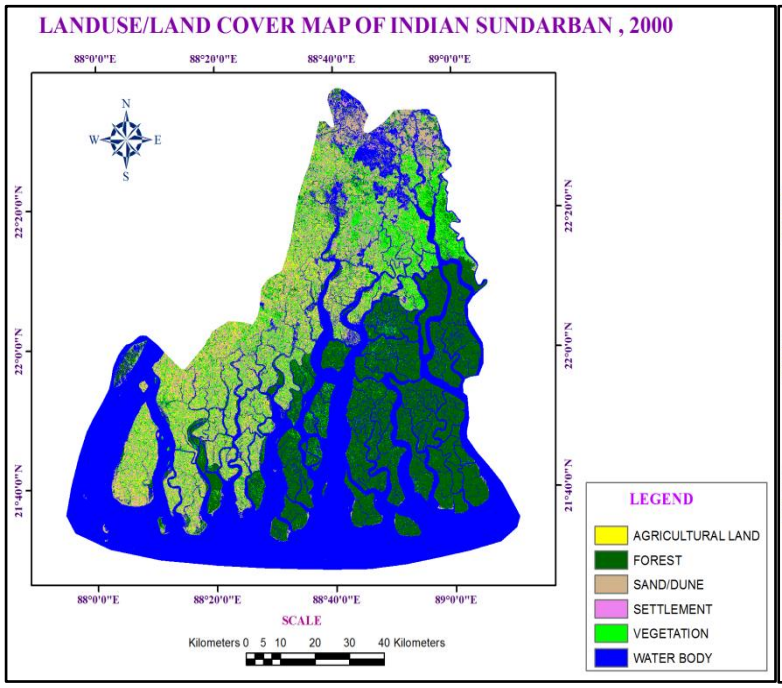

Fig. 4, Land use Land cover map of Sundarban in 2000

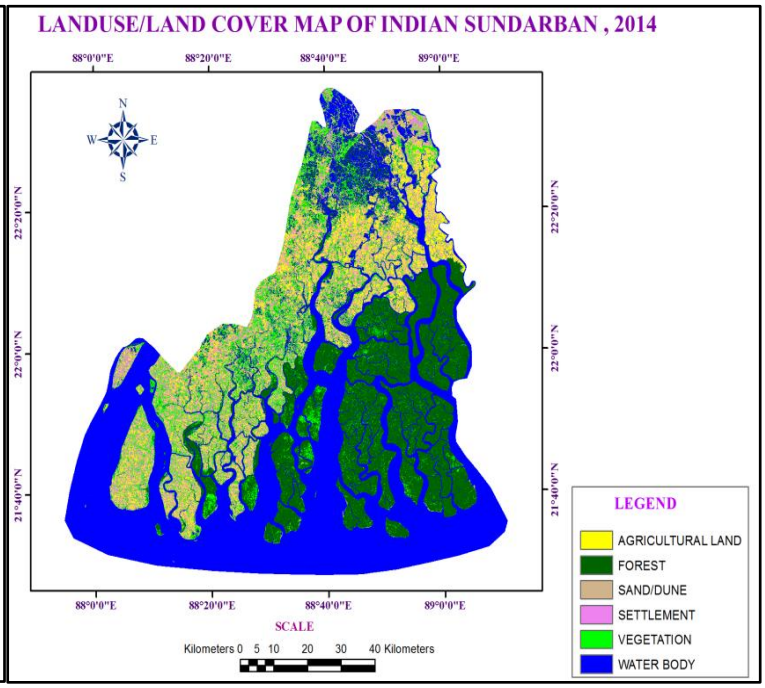

Fig. - 5, Land use Land cover map of Sundarban in 2014

Table 1: Year Wise LULC Area of Indian Sundarban.

SL NO.	AREA IN SQ/KM			
	LANDUSE CLASS	**1973**	**1989**	**2000**	**2014**
1	**AGRICULTURAL LAND**	1195.01	1034.32	917.58	875.20
2	**VEGETATION**	3291.61	3255.37	3148.63	3126.42
3	**SETTLEMENT**	912.45	982.79	1159.33	1196.24
4	**SAND/DUNE**	179.60	277.99	280.32	290.35
5	**WATER BODY**	4136.84	4165.05	4209.65	4227.30

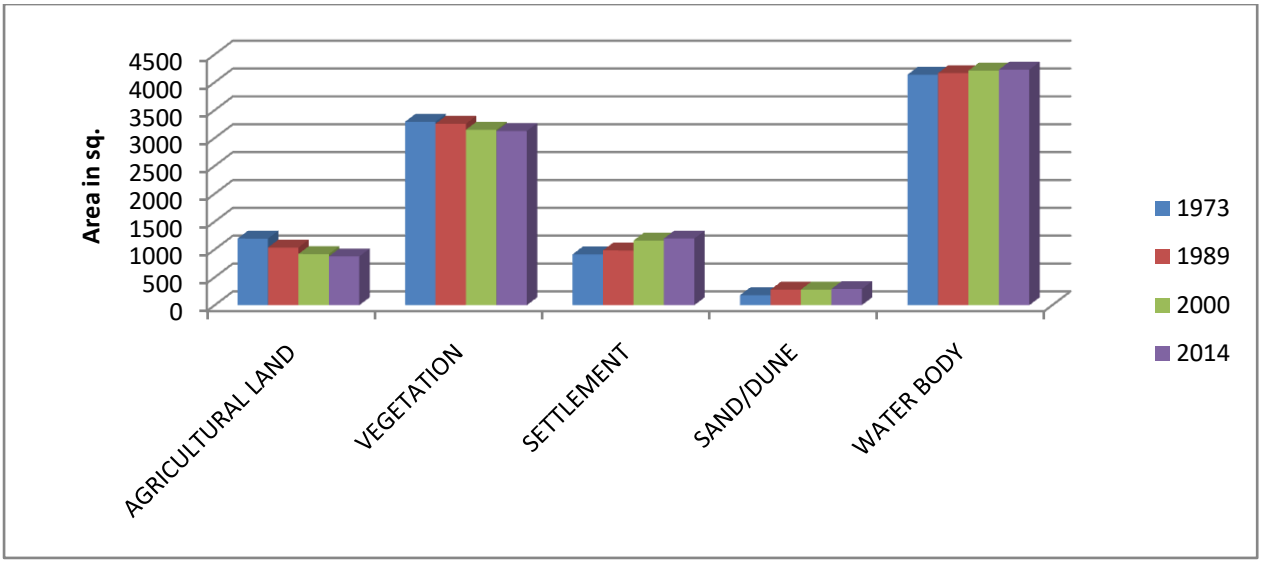

Fig. 6: Graphical Representation of LULC Statistics of Indian Sundarban from 1973 to 2014.

Land use land cover classifications have been done by using satellite images with the help of remote sensing and geographical information system. In this study present researcher has used 4 years USGS satellite data respectively 1973, 1989, 2000, 2014 with the interval of 10 to 12 years and collected different land categories to make comparative study of land use land cover transfiguration of Indian Sundarban Delta. From this analysis it can be measure that Agriculture land is decreasing i.e. in 1973 the area was 1195.01 sq. km. but in 2014 it decreased to 875.20 sq. km.Vegetation cover also slowly decreased. The major finding in this study is settlement is increasing rapidly. In 1973, 912.45 sq. km. area was occupied by settlement, in 1989, 982.79 sq. km., in 2000 it was increased to 1159.33 sq. km., and finally in 2014 the area occupied 1159.33 sq. km.In this study the area of water body considered as whole and sandy area in 2014, it was 290.35 sq. km.

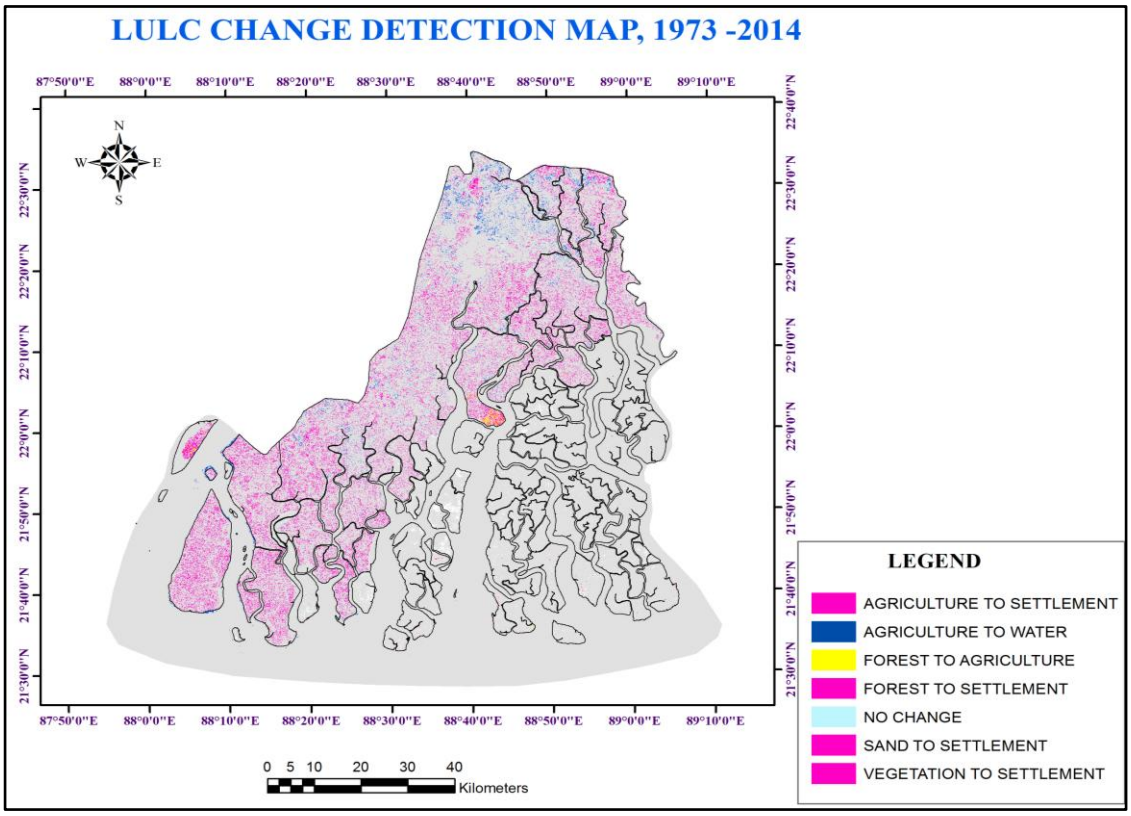

Fig. 7, Change Detection of Land Use Land Cover, Indian Sundarban (1973-2014

Table no.2: LULC Change Detection Data 1973 – 2014

1973/2014	AGRICULTURAL LAND	VEGETATION	SETTLEMENT	SAND/DUNE	WATER BODY
AGRICULTURAL LAND	0	0	234.43	0	76.86
VEGETATION	10.12	0	234.54	0	0
SETTLEMENT	0	0	0	0	0
SAND/DUNE	0	0	36.28	0	0
WATER BODY	0	0	0	0	0

In Remote sensing and GIS, Change detection is useful in many applications such as land use changes, habitat fragmentation, and rate of deforestation, coastal change, urban sprawl, and other cumulative changes through spatial and temporal analysis techniques. Change detection refers to the process of identifying differences in the state of land features by observing them at different times. A change detection map has been prepared by overlying of different multi temporal images. The land use land cover change detection studies from 1973 to 2014 year, has been accomplished with the help of existing map and satellite image

using GIS techniques. From change detection can be measured land transformation details of different land categories. It is measure that there is a change in the agricultural land 234.43 sq. /km area changes into settlement, and 76.867 sq. /km areas converted into water body in 2014. Vegetation converted 234.94 sq. /km area change to settlement in 2014. 10.12 sq. /km area forest area converted into agricultural land. 36.28 sq. /km Sand/dune converted into settlement.

Conclusion andFindings

A careful study of land use land cover transfiguration in Sundarban has established some notable findings. In this concluding part it is imperative to say that there are many changes occurring in the islands of Sundarban. Present research carries out the change detection specially land use changes. With the extensive mapping techniques applied to state out the overall transformation in accordance with deltaic landscape. The geomorphological and geological dynamics of the concerned area has of immense contribution to the diversification of island geomorphology. It may lead to understand precisely on the changing behavior of various lands mass. As per the current study it can be stated that the studied regions are over sensitive by its gradual erosion, deposition and anthropogenic activities.
There are many changes occurring in the Indian Sundarban area between 1786 to 2014. In Land Use land cover changes, Human habitation increased and its effects on vegetation cover, Agriculture land. Most of the areas were no changed in Land use Land cover they are mainly Southeastern Island which are covered with Mangrove forest.

Acknowledgements

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