

URBAN SPRAWL AND ITS IMPACTS ON LAND USE/LAND COVER (Case study of two major cities in Tamil Nadu)

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ABSTRACT

Universally urban Sprawl is increasing day by day. The rapid urban Sprawl affects the land use and land cover, mainly agricultural Land and water body. Fertile land and water body are major need for human life. The high degrees of degradation of the above are questionable to the food security of the India. There is the urgent need to study the level of resource degradation due to urban Sprawl. In 2020 urban sprawl is expected to affect 15 Million hectares Prime Agriculture Land in India. In Tamil Nadu currently rapid urbanisation has been identified in Coimbatore and Erode town. The study has been conducted for 10 kilometres radius from the Coimbatore and Erode town, and investigated for the urban expansion and its impact on land use land cover. Comparatively both the cities, land use changes are analyses and assessed individually. Temporal growth and changes over period of urban details are derived and assessed using ARCMAP and ERADAS software. Finally in this paper explored that Unplanned urban growth and large segment of the local population are destructing the valuable Land system. Techniques for the planning and management of land resources specifically integrated and holistic will check long term quality of the land for human use. The prevention and resolutions of social conflicts related to land use was control the negative impact of urban Sprawl.

Keyword: Urban sprawl, Land use, agricultural land loss.

INTRODUCTION

Urban sprawl is commonly used to describe physically expanding urban area. The spatial pattern of urban sprawl over different time periods increased day by day. Urban growth and the concentration of people in urban area are creating social problem world wide. According to the expert predictions, the urbanisation and growth of urban centres in the future will be far more spectacular than ever before. It is also expected that owing to population growth, globalisation, and liberalisation of the economy there will be a fast paced growth of urbanisation bringing about an economic impact on the economy.

Fifty year ago, approximately 15% of the world's population was living in urban area. Today the percentage is nearly 50%. In the last 200 years world population has increased six times, and it's stressing to ecological and social system. Over that same time period, the urban population has increase 100 times, concentrating more people on less land even as the total land devoted to urbanization expands. In India alone currently 29.73% of the population live in the urban centres, while it is projected that in the next fifteen years about 42% would be living in the urban centres. This indicates the alarming rate of urbanisation and the extent of sprawl that could take place. In the midst of urban and industrial expansion, there is increasing pressure on important resource predominantly in the metropolitan cities. The urbanization which lacks in infrastructure facilities has post serious implication on the resource base of the region. The cities are growing in all direction resulting into changes in urban land use region.

In India, unprecedented population growth coupled with unplanned developmental an activity has resulted in rapid but skewed urbanization. This has posed serious

Implication on the resource base, access to infrastructure and the development of the region. The problems created by the haphazard and unrestricted growth of city aggravates irregular and chaotic development of residential, industrial and commercial areas resulting in traffic bottle necks, slums, polluted environment and others all known and felt by the residents of the city. The urbanization takes place either in radial direction around a well-established city or linearly along the highways. It's reflected on the border or rural area as compared to the city centre. This dispersed development along highways or surrounding the city and in rural countryside is generally referred as Sprawl. Sprawl is a term that is often used to describe perceived inefficiencies of

development, including disproportionate growth of urban areas and excessive leapfrog development. Sprawl is a cumulative result of many individual decisions and it requires not only an understanding of the factors that motivate an individual landowner to convert land, but also an understanding of how these factors and individual land-use decisions aggregate over space. Some of the causes of the sprawl include - population growth, economy and Proximity to resources and basic amenities. As cities enlarge, agricultural land and habitats like forest are transformed into land for housing road, industry, etc. Some of the fallow land and wasteland also partly converted into urban area. Since the settlement need water potential the double crop land are converted faster manner. In this connection there is an urgent need to assess the urban stress on the Land use. Any disturbance to this resource by way of change in land use e.g. conversion of forestland, agricultural land into built-up, is irreversible. The use of land unsuitable for development may be unsustainable for the natural environment as well as to the humans. In order to understand this increasing rate of urban sprawl, an attempt is made to understand the sprawl dynamics and evolve appropriate management strategies that could aid in the region's sustainable development.

STUDY AREA:

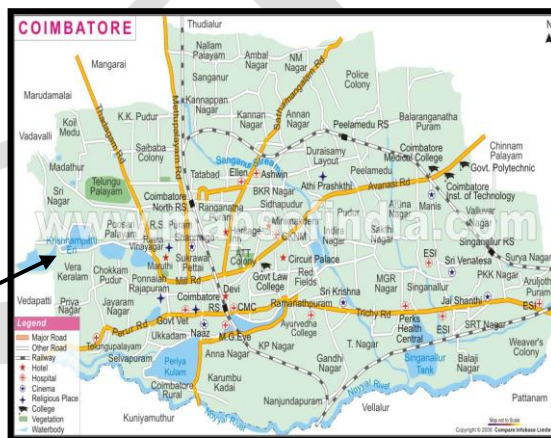
Coimbatore and Erode its Environs:

Coimbatore and Erode is a historical cities situated at the geographical centre of Tamil Nadu state in India. Coimbatore is situated in the extreme west of Tamil Nadu, near the state of Kerala. It is surrounded by mountains on the west, with reserve forests and the Nilgiri Biosphere Reserve on the northern side. The eastern side of the district, including the city is predominantly dry. The entire western and northern part of the district borders the Western Ghats with the Nilgiri biosphere as well as the Anaimalai and Munnar ranges and it is located between $11^{\circ} 1'6''$ N $76^{\circ} 58'29''$ E. Coimbatore is located at an elevation of about 398 meters. As of the 2011 Coimbatore had a population of 930,882 in Municipal Corporation limits. Males constitute 52% of the population and females 48%. Coimbatore has an average literacy rate of 78%, higher than the national average of 59.5%. Male literacy is 81% and female literacy is 74% with 11% of the population under 6 years of age. Erode, a special grade Municipal Town is

located at a distance of 100 Km from East of Coimbatore and is situated on the bank of river Cauvery between $11^{\circ} 19.5''$ and $11^{\circ} 81.05''$ North latitude and $77^{\circ} 42.5''$ and $77^{\circ} 44.5''$ East latitude. Erode local planning over an area of 76.21 Sq km with the population of about 5 lakhs (District) and about 30 lakhs (District) as per 2009. It is the fourth largest city in Tamil Nadu area wise. It has an average elevation of 183 metres (600 feet). Erode District lies on the extreme north of Tamil Nadu. It is bounded mostly by Karnataka state and also Cauvery covers pretty long distance. To the east lies a Namakkal and Karur district.

COIMBATORE

TAMIL NADU



ERODE



Map 1. Location map of the Coimbatore and Erode City

NEED FOR STUDY

Urban development is rapidly gaining attention worldwide because it is directly linked to land use changes and population increase. The world's urban population was estimated at 3 billion in year 2003 and is expected to rise to 5 billion by year 2030. Urban sprawl is a worldwide phenomenon. During the rapid urban development process, many unsatisfying phenomena occurs, for e.g. uncontrolled urban expansion, encroachment of agricultural area, and stress on infrastructures services etc. There is urgent need to study the level of resource degradation due to urbanisation.

The urban sprawl is increased day by day affecting the agricultural land so that the crop production decreased and its impact seen in economic development. In developed countries about 3,000 sq Km area of agricultural land is converted every year into urban growth. There is a need to conserve natural environment and maintain the sustainability of urban centres. Hence, there is a need to improve and protect the natural environment and maintain the sustainability of cities taking human comfort into consideration. Urbanization in India has never been a rapid as it is in recent times. As one of the fastest growing economics in the world, India faces stiff challenges in managing the urban sprawl. The urban areas contribute significantly to the national economy, while facing critical challenges in accessing basic services and necessary infrastructure, both social and economic. The overall rise in the population of the urban or the increase in travel times due to the congestion along road network are indicators of the effectiveness of planning and governance in assessing and catering to this demand. The rapid growth of the population, haphazard expansion of local planning area and rapid destruction of agriculture lands are common Problems in the Coimbatore and Erode Study Area. The present study area needs special attention to study the land use and land cover pattern and its changes with time using remote sensing Data.

OBJECTIVE

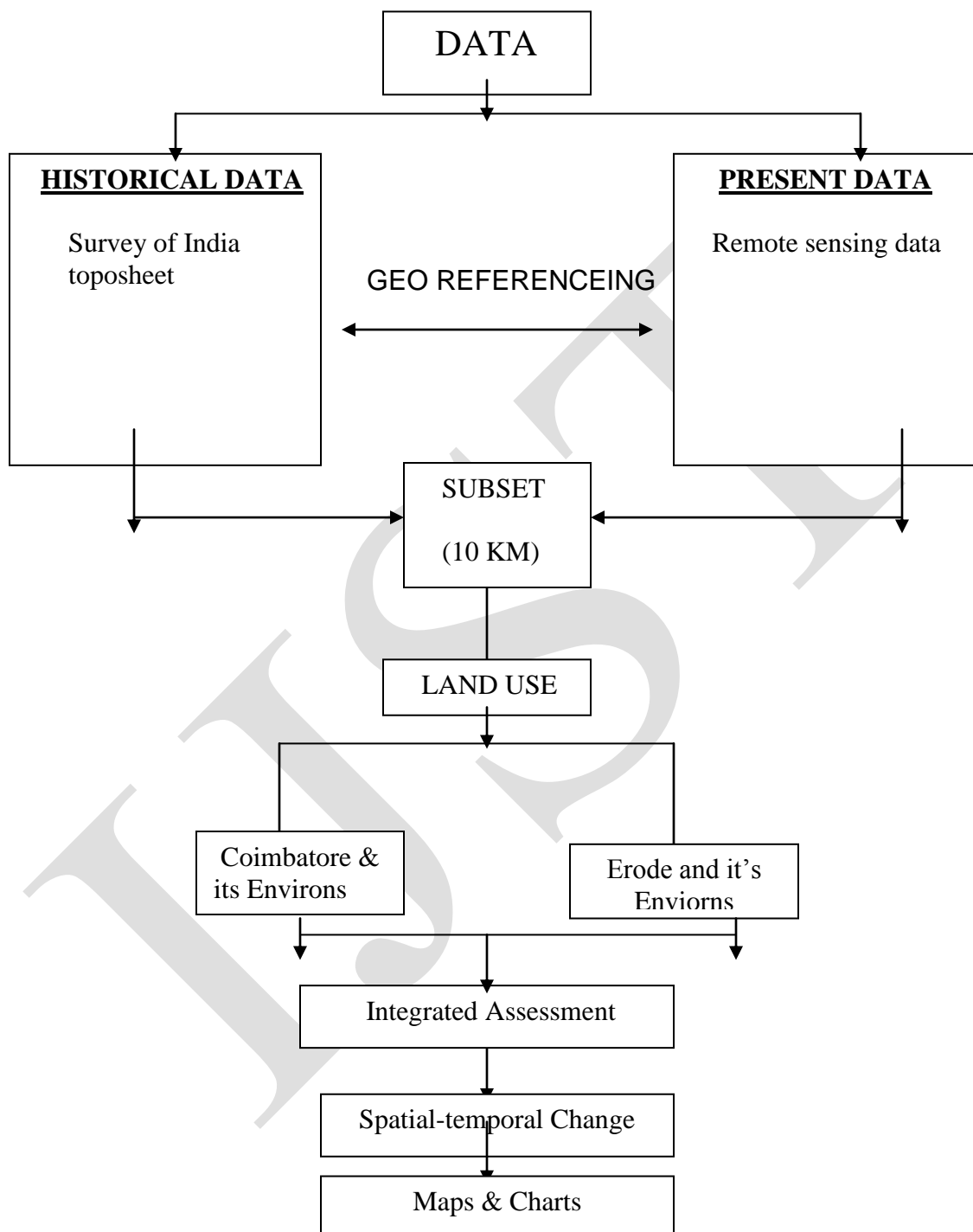
- To study the urban sprawl and the dynamic of land use/land cover for the two cities
- To identified the Percentage of land use/land cover chances for 1971 to 2001

DATA COLLECTION - MATERIALS AND SOURCE

Table-1: Details of the data collected for the Study Area

COIMBATORE AND ERODE	SOURCE
Toposheets No. 58 A/16 SE, 58 F/1 NW, 58 E/4 SW	Survey of India, Scale 1:50,000
Satellite imagery – landsat MSS: Path: 154, Row: 52 TM : path: 144, Row: 52 and Path: 143, Row: 52 ETM : path: 144, Row: 52 and Path: 143, Row: 52	National Remote Sensing Agency (NRSA)
Demographic details from primary census abstracts for 1971, 1981 & 1991	Directorate of Census Operations, Census of India

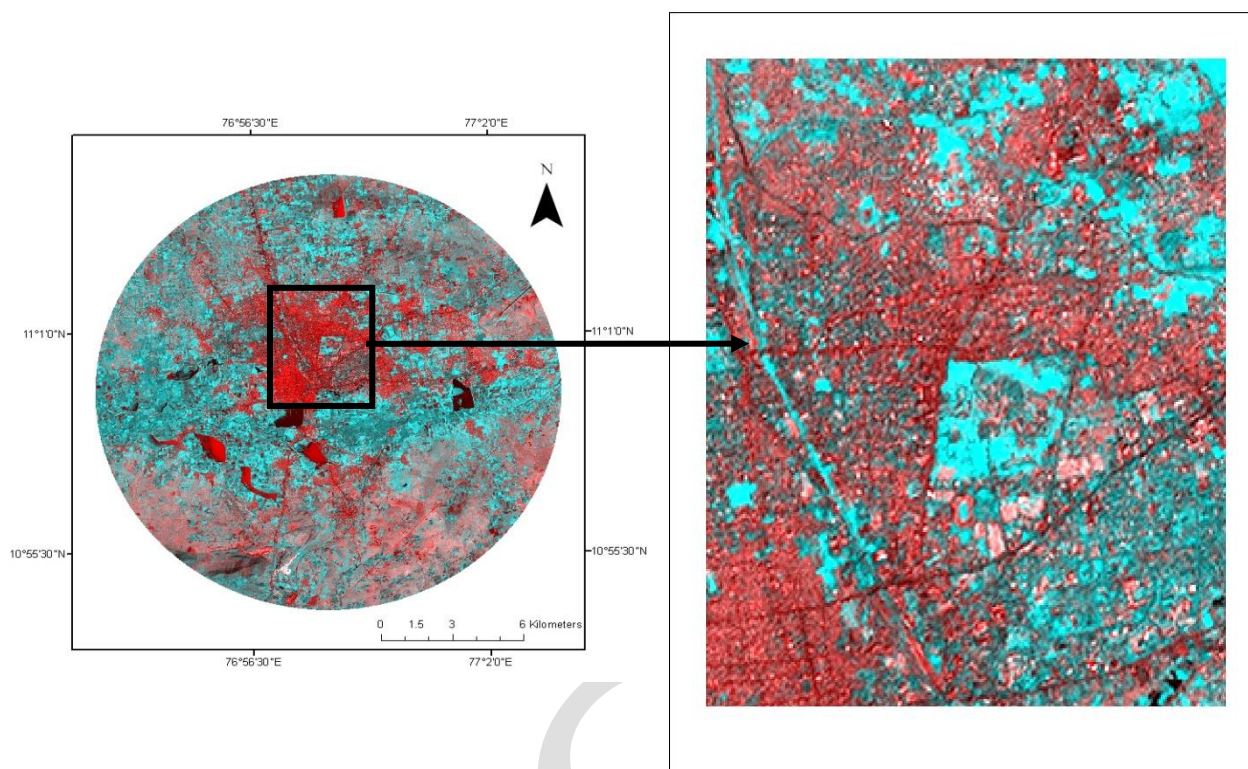
Fig.1 METHODOLOGY FLOW CHAT



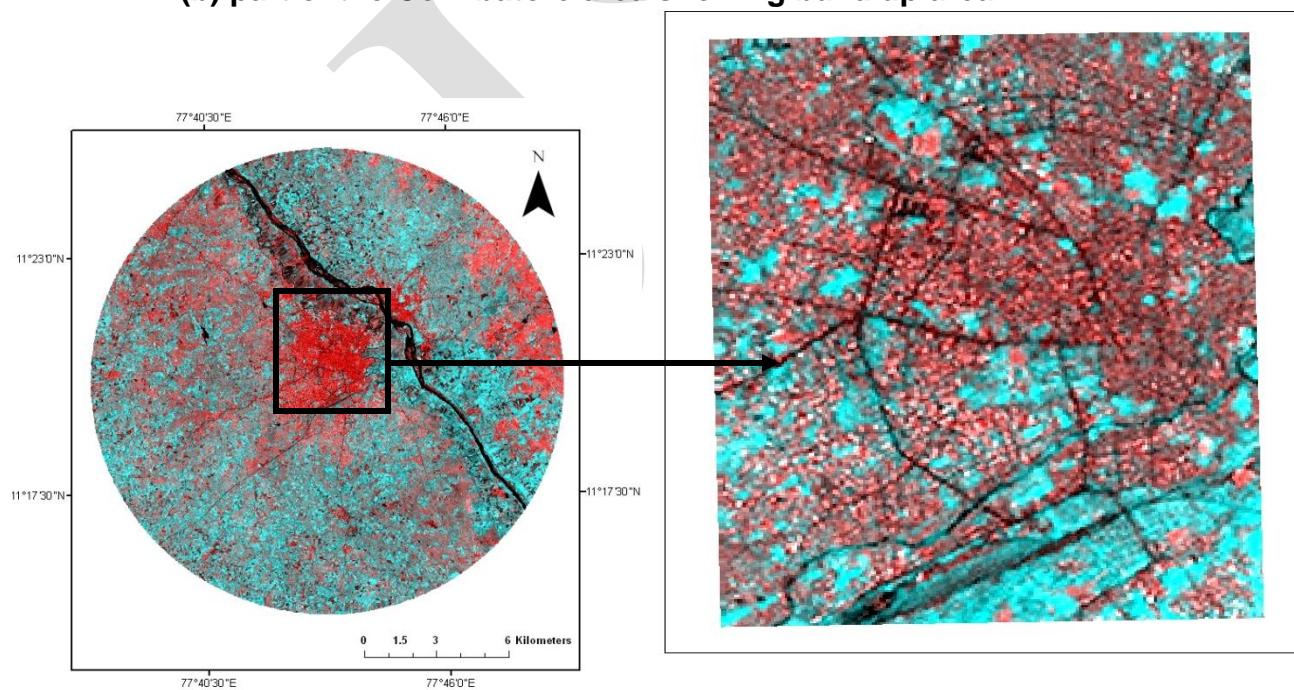
METHODOLOGY

In the present study use technique of remote sensing and GIS to monitor the urban growth from 1971 to 2001 for the area of Coimbatore and Erode cities. Base map prepared using survey of India toposheet in the year 1971 on the 1: 50,000 scale. The Toposheets was scanned and Geo-referenced. Coimbatore and Erode cities and the village boundary of the two districts are digitized in Arc map. From the city centre 10 Km radius area clipped from the digitized vector layer using spatial analysis tool in Arc tool box. Urban expansion is difficult to determine by the boundary; So that I limited my study boundary within the 10km radius from the city centre. Using vector layer base map has been prepared.

Different time period images are used for detecting the characteristics of land use change. In this study, used multi temporal satellite data obtained from MSS and ETM sensors carried by resource Land sat satellite. The area falls in path/row 144&53 and 144& 52 respectively. The required satellite imagery for the study area was collected. All the data are preprocessed and projected to the Universal Transverse Mercator (UTM) projection system. The obtained maps are studied and analyzed to identify the change in urban area due to urban sprawl. Satellite data were imported into the image processing software to create a False colour Composite (FCC). The FCC is generated for the study area through Layer stack option in image interpreter tool box. The FCC is generated for the Coimbatore and erode city and 10KM radius area is extracted from the false colour composite for the land use classification base on the digitized vector layer. In this study supervised classification was applied to classify images into different classes of LULC. LULC training sites were prepared representing each known LULC category that appears fairly homogeneous on the image. In total Five LULC classes were recognized. Using these signature files, supervised classification was done by parallelepiped principal algorithm processing in ERDAS IMAGINE 8.5 software. Accuracy of the classification of each datasets and classifier was expressed as an error matrix from which the overall accuracy, user's accuracy, producer's accuracy, the Kappa statistics were derived. These image classification algorithms provided better accuracy of 92% and 93% algorithms provided better accuracy of 92% and 93% respectively for the year 1971 and 2001 for both the cities.



**Map.2 (a). FCC imagery of the Coimbatore city and its environs
(b).part of the Coimbatore area showing build up area.**



**Map 3.(a). FCC imagery of the Erode city and its environs
(b). Part of the Erode area showing build up area.**

Result and Discussion:

The classified image provides all the information to understand the land use and land cover of the study area. Change detection analyses describes and quantify differences between images of the same scene at different times. The classified images of the Different dates can be used to calculate the area of different land cover and observe the changes that are taking place in the span of data. This analysis is very much helpful to identify various changes occurring in different classes of land use like increase in urban built-up area or decrease in vegetation and so on. The classified images obtained after supervised classification which are showing the detailed information about the land use and land cover of the Coimbatore and Erode cities. Both the cities are traditionally known for having good education centers, high potential groundwater resource, well connected road & rail networks and pilgrimage centre. So that people prefer to settle at Cities for the above said reasons. Because of the steady growth in population in the study area, urban sprawl has extended outward by encroaching nearby fertile agricultural land and water tanks. This is well shown in our present study (Table.1 & 2). The classified landuse and land cover map for the year 1971 and 2001 shown in the Map 4 & 5 respectively.

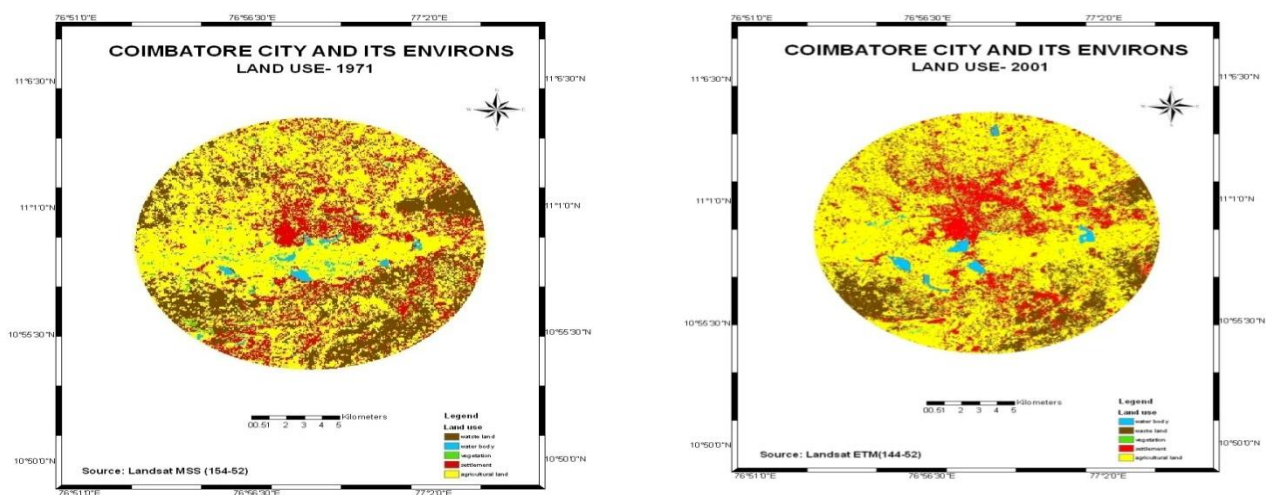
Settlement: Coimbatore city settlement in 1971 was about 11627 Hectares (38.6%), while in the year 2001 the settlement drastically increased by 14984 Hectares (49.8%). Over the Period of 30 years settlement was increased about 3357 Hectares (11.2%). And Erode area settlement in 1971 was about 1584 Hectares (5.15%), while in the year 2001 the settlement drastically increased by 4261 Hectares (14%). Over the Period of 30 years settlement was increased about 2677 Hectares (8.86%). This change was mainly due to expansion of urban in the form of newly developed area in around cities. This change was mainly due to expansion of urban in the form of newly developed area in around cities.

Water Bodies: In Erode 1971, the area of surface water body was 501 Hectares (4.6%). While in the year 2001, it has drastically reduced to 419 Hectares (1.4%). In Coimbatore 1971, the area of surface water body (rivers, streams, lakes, tanks and reservoirs) was 1117 Hectares (3.7%). While in the year 2001, it has drastically reduced

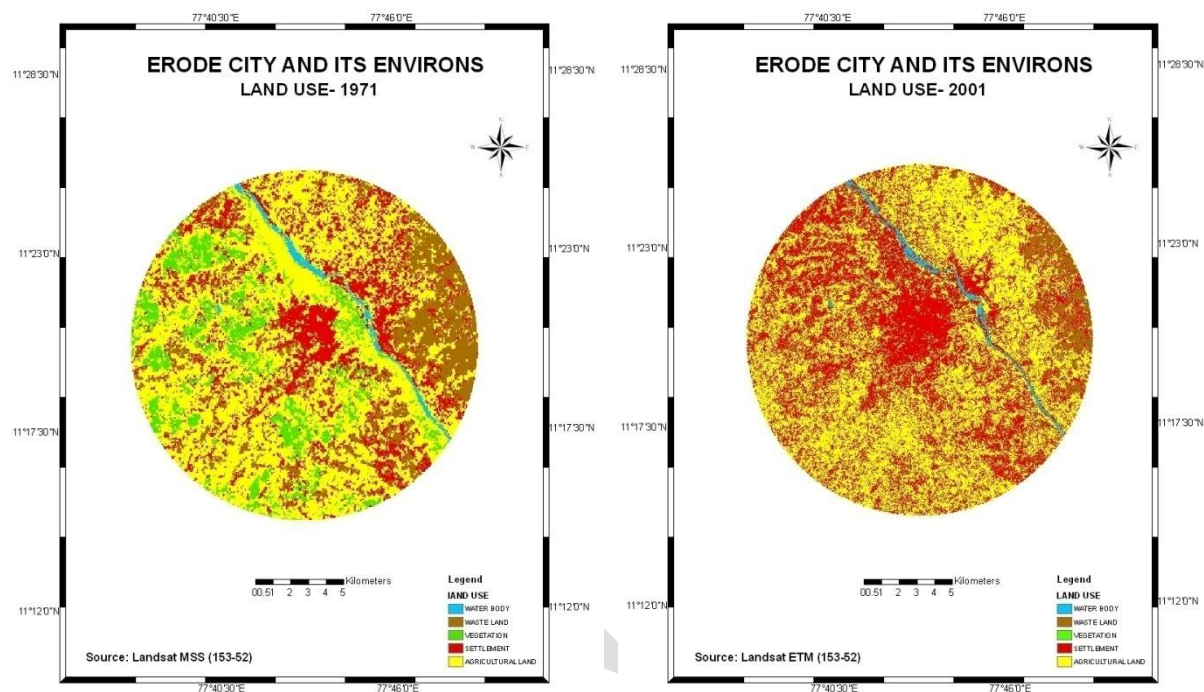
to 754 Hectares (2.5%). For the 30 years about 363 Hectares area of the surface water bodies decreased and converted as government buildings, settlements and some converted as government buildings, settlements and some improper maintenance.

Agricultural Land: The total agriculture land in Coimbatore Study area (crop land and plantation) in 1971 was about 6833 Hectares (22.7%) in 1999 was about 4746 Hectares (15.8%). the last 30 years total area of the agriculture land was decreased about 2087 Hectares. In Erode 1971, the area of agriculture land was 17216 Hectares (56.3%), While in the year 2001, it has drastically reduced to 14852 Hectares (45.5%). The agricultural land was mainly converted as settlement and partly as mining area. Because of the development of the city, the land value has escalated and caused the conversion of agricultural land to settlement. As Same Way Waste Land and Vegetation percentage also reduced both Cities in Different rate.

From the Table one can easily identify exactly where the agricultural and waste land was transformed into settlements. New settlement such as were developed within agricultural area. These transformation activities have reduced the agricultural area. Due to the infrastructural developmental activity, new bye-pass roads, ring roads and four way lanes were constructed within the city. These newly developed roads facilitate the development of new industrial and settlement area along the sides of these roads and caused the reduction in agricultural area.



Map 4. Land use/Land Cover map for Coimbatore city and its environs (1971-2001)



Map 5.Land use map for Erode city and its environs (1971-2001)

Table-2: Land-use changes from 1971 to 2001 of Coimbatore city and its environs

Land use	Hectares (1971)	Percentage of Total Geographic area(TGA)	Hectares (2001)	Percentage of Total Geographic area(TGA)	changes in Hectares	Percentage of changes %
built-up area	11627	38.6	14984	49.8	3357	11.2
Agricultural land	6833	22.7	4746	15.8	2087	6.9
Water body	1117	3.7	754	2.5	363	12
Vegetation	3044	10.4	2701	9	343	1.4
Waste land	7802	26	5552	18.5	2250	7.5

Table-3: Land-use changes from 1971 to 2001 of Erode city and its environs

Land use	Hectares (1971)	Percentage of Total Geographic area(TGA)	Hectares (2001)	Percentage of Total Geographic area(TGA)	changes in Hectares	Percentage of changes %
built-up area	1584	5.15	4261	14	2677	8.85
Agricultural land	17216	56.3	14852	45.5	2,364	10.8
Water body	501	4.6	419	1.4	82	3.2
Vegetation	3267	10.6	2693	8.8	574	1.8
Waste land	8089	23.75	8432	27.5	343	3.75

CONCLUSION

The present study reveals the possibility of applying Remote Sensing and Geographical Information Systems techniques on evaluating the loss of agricultural land due to urban expansion and also on the exploitation of other environmental natural resources. Remote sensing has the capability of monitoring such changes, extracting the change in information from satellite data. The results showed that urbanization leads to LULC change and landscape pattern alteration which responded obviously to the urbanization phases. The loss of agricultural land and water bodies due to urban expansion in Study area cannot be totally halted, but needs sustainable planning and management in protecting the loss of agricultural land and water bodies. Urban expansion has led to degradation of ecosystem. The provided information also assists in monitoring the dynamics of land use resulting out of changing demands of increasing population. From this analysis we understand the urbanisation is taking place rapidly in the two cities in the different rate. Consequently agricultural land encroachment is gradually increased in to cities. Totally 4451 ha land loss in the two cities due to urban development. Coimbatore and Erode are main cities in Tamil Nadu and commercial city for the state. So that It is experiencing a rapid urbanization. The urban sprawl is seen as one of the potential threats to sustainable development where urban planning with

effective resource utilization and allocation of infrastructure initiatives are key concerns. Information on land use / land cover and possibilities for their optimal use is essential for the selection, planning and implementation of land use schemes to meet the increasing demands for basic human needs and welfare. This information also assists in monitoring the dynamics of land use resulting out of changing demands of increasing population.

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