UGC Journal Details

Name of the Journal :	Current Global Reviewer
ISSN Number :	23198648
e-ISSN Number :	
Source:	UNIV
Subject:	Earth and Planetary Sciences(all);Geography, Planning and Development
Publisher:	Shaurya Publication
Country of Publication:	India
Broad Subject Category:	Science

Print

KVN Naik Arts, Commerce & Science College, IQAC OFFICE

Co-ordinator
I.Q.A.C.
KVN Naik Arts, Commerce
& Science College, Canada Corner,
Nashik-422 002.

(15)

ISSN 2319-8648

Current Global Reviewer

International Research Journal Registered & Recognized Higher Education For All Subjects & All Languages

Editor In Chief

Arun B. Godam

Assessment of Land use/ Land cover Changes in Pimpri - Chinchawad Municipal Corporation using Geo-Spatial Techniques

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ABSTRACT

Land use is the way in which, and the purposes for which, human beings employ the land and its resources: for example, farming, mining, or lumbering. Land cover describes the physical state of the land surface: as in cropland, mountains, or forests. The term land cover originally referred to the kind and state of vegetation (such as forest or grass cover), but it has broadened in subsequent usage to include human structures such as buildings or pavement and other aspects of the natural environment, such as soil type, biodiversity, and surface and groundwater. The present study highlights a coordinated significance of Remote Sensing and GIS techniques in detecting land use changes that have been experienced in last fifteen years in PCMC and its surrounding areas. Remote sensing applications with the availability of high resolution data from the state of the art satellites like LANDASAT accompanied with the image processing technique is an effective GIS tool for identifying the urban growth pattern from the spatial and temporal data. PCMC in India is growing at a very fast rate. On the above background, the precise aim of this present study is to find out land use / land cover of PCMC. The spatial patterns of land use / land cover over different time periods, can be mapped, monitored and accurately assessed from satellite data along with conventional ground data. Landsat images of two different periods were analyzed to evaluate urban growth rate as well as LU/LC changes. Hybrid classification techniques used in this study.

Keywords: *LU/LC, Remote Sensing and GIS, Multi-temporal Satellite Imageries, Overlay Analysis.*

Introduction

Advancement of information technology has provided wide arrays of new digital tools that can support the generic activity of geographical analysis and urban modal. In spatial decision-making and designing, in particular, these tools support different stages of the process which involve rapid and effective storage and retrieval of information, various kinds of visualization to inform survey and analysis, and different strategies for communicating information and plans to the affected community (Delaney, 2000).

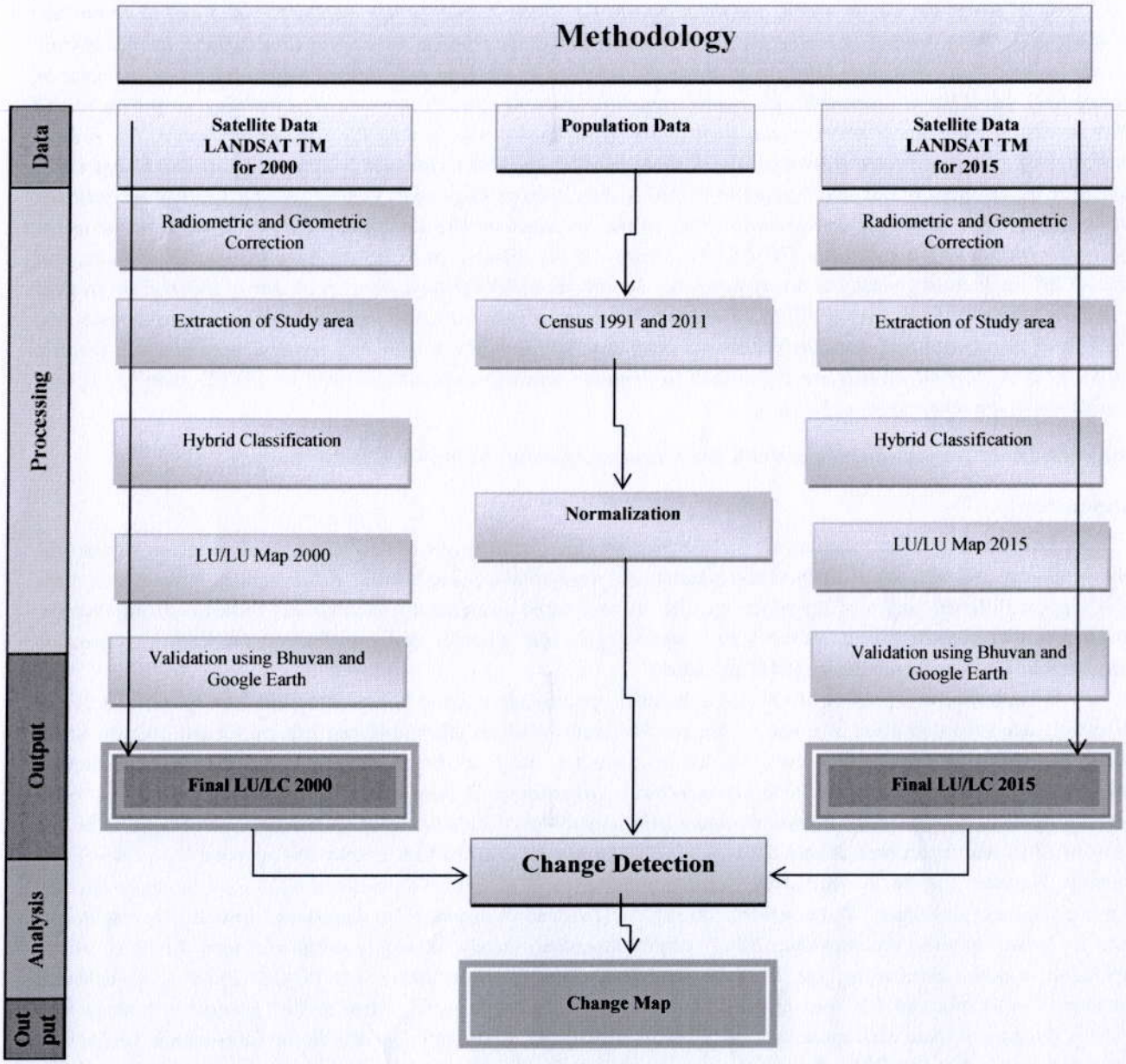
Urbanization is a process of villages to be developed into towns and further into cities and so on. There is no universally accepted definition of urban settlement. Different countries adopt different criteria for defining the urban settlement. Urban places are not even similar in character. This can be distinguished on the basis of defined demographic characteristic and available infrastructures. Urbanization is the process through which the forests, fertile agricultural lands, surface water bodies are being irretrievably lost, (Pathan, 1991). In India the percentage of people living in cities and urban area almost doubled to 27.78% in year 2001, which is very low as compare to developed countries. However, the 28.53 crore urban population living in 27 metros, 396 cities and 4738 towns is more than the total population of developing and developed countries. This kind of uncontrolled, haphazard, low density settlements leads to Urban sprawl (Vinothkumar, 2005). The Maharashtra state is a highly urbanized with 42.40 % of the population in urban areas as against 27.78 % at all India level (Census, 2001). The PCMC (Pimpri - Chinchawad Municipal Corporation) 94.4 % was recorded highest growth of population according to 2001, census in Maharashtra, which is the part of Pune Metropolitan region. This is mainly due to the rapid growth in the Information Technology sector. Between 1991 and 2001, the population growth has doubled to 62.17 %. In comparison; Pune district has a growth rate of 38.58 %, while the state is experiencing the growth rate of 22.5 %.

The precise aim of the present work is to find out land use / land cover in Pimpri Chinchwad.

Location and Extent of Study area

Pimpri-Chinchwad lies between 18° 34' to 18° 43' North latitude and 73° 43' to 73° 56' East longitude. Pimpri-Chinchwad (PCMC) area covers 178.35 sq. km. composed of 4 administrative wards of Pimpri-Chinchwad Municipal Corporation. The PCMC is situated in to the Northwest of Pune on the Mumbai-Pune National Highway at an average altitude of 530 to 566 m. from mean sea level. The east-west ridge running midway between Indrayani and Pavana rivers separate this area into two parts. The northern portion slopes towards Indrayani River while the southern portion slopes towards Pavana river.

Database and Methodology



Land cover/land use change analysis

For performing LU/LC change, analysis in ArcGIS software following steps was applied for hybrid classification process. This process includes Unsuperwised, Superwised and Manual Digitization. The resultant image with classes was obtained in many classes under hybrid classification scheme. The verification for each class was met out by checking and assigning each class with minimum and maximum values. The various subclasses under the main classification i.e. Level-I classes were merged under five main heads and each was assigned a different color through changing maximum and minimum values in lookup table for raster layers of 2000 and 2015. We came out with Land use / landcover patterns for both 2000 and 2015 as the outcome with visible marked differences.

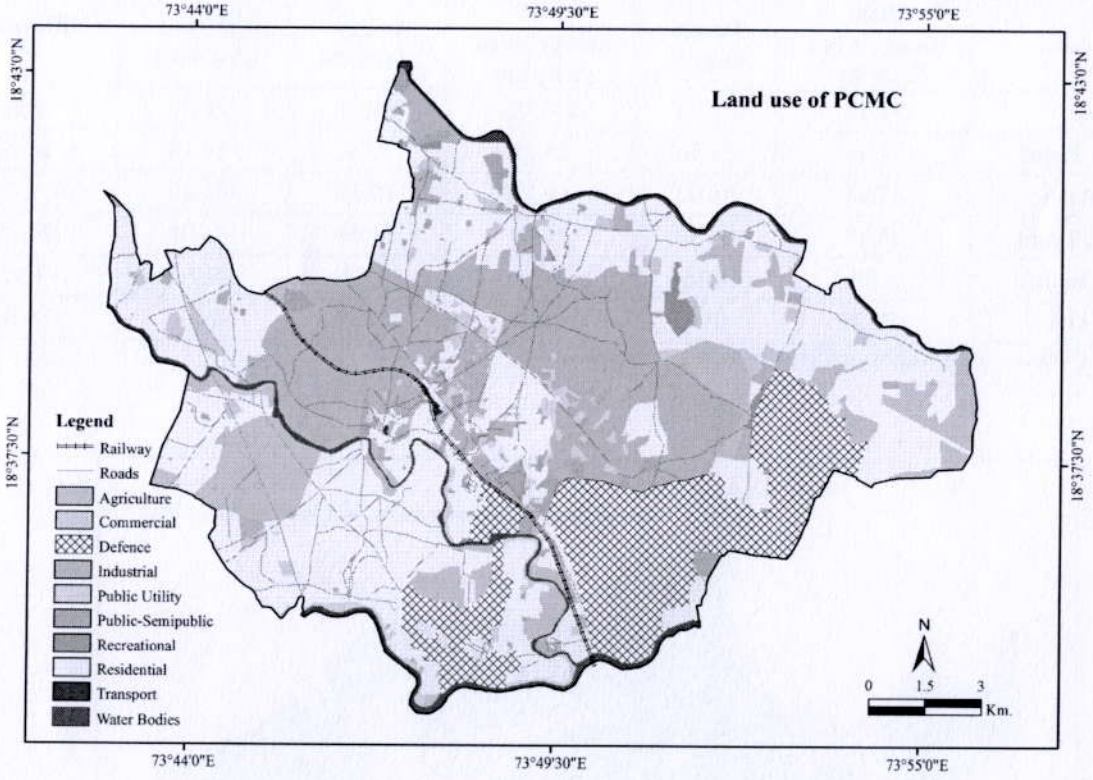


Fig. 1

Role of geo-spatial techniques

The modern technology of remote sensing includes aerial as well as satellite based systems, allowing us to collect a lot of physical data rather easily, with speed and on repetitive basis, and together with GIS helps us to analyze the data spatially, offering possibilities of generating various options (modeling), thereby optimizing the whole planning process. These information systems also offers interpretation of physical (spatial) data with other socio-economic data, and thereby providing an important linkage in the total planning process and making it more effective and meaningful.

The satellite remote sensing has the ability to provide the accurate and reliable information to make a map and to monitor various facts of urban development.

Results and discussions

The data obtained through the analysis of multi-temporal satellite imageries are registered in Table 1 and the results are diagrammatically illustrated in Figs 1 and 2. Depicts LU/LC status of two study periods i.e., 2000 and 2015 (Fig. 3); depicts LU/LC change from 2000 to 2015 in different land use categories in built-up area, Forest, Barren land, Agricultural land and water bodies. The areas of different landuse classes were calculated for the both years through GIS and the difference with respect to change in LU/LC was studied for the fifteen years period and the results were statistically tabulated.

Table 1 Land use / Land cover change (2000 to 2015)

Class	2000 Image Area in sq km	Image Area %	2015 Image Area in sq km	Image Area %	Difference (Sq. km)	Difference %
Built-up	48.56	27.23	117.42	65.84	99.26	17.28
Fallow Land	24.18	13.56	14.08	7.89	-13.18	-16.29
Vegetation	62.45	35.02	19.25	10.79	-51.40	-51.66
Barren Land	36.27	20.34	21.29	11.94	-33.94	-24.33
Water bodies	6.89	3.86	6.31	3.54	-0.74	-3.35
TGA	**178.35**	**100**	**178.35**	**100.00**	0.00	-78.35

(Source: Computed by Authors) **TGA- Total Geographical Area**

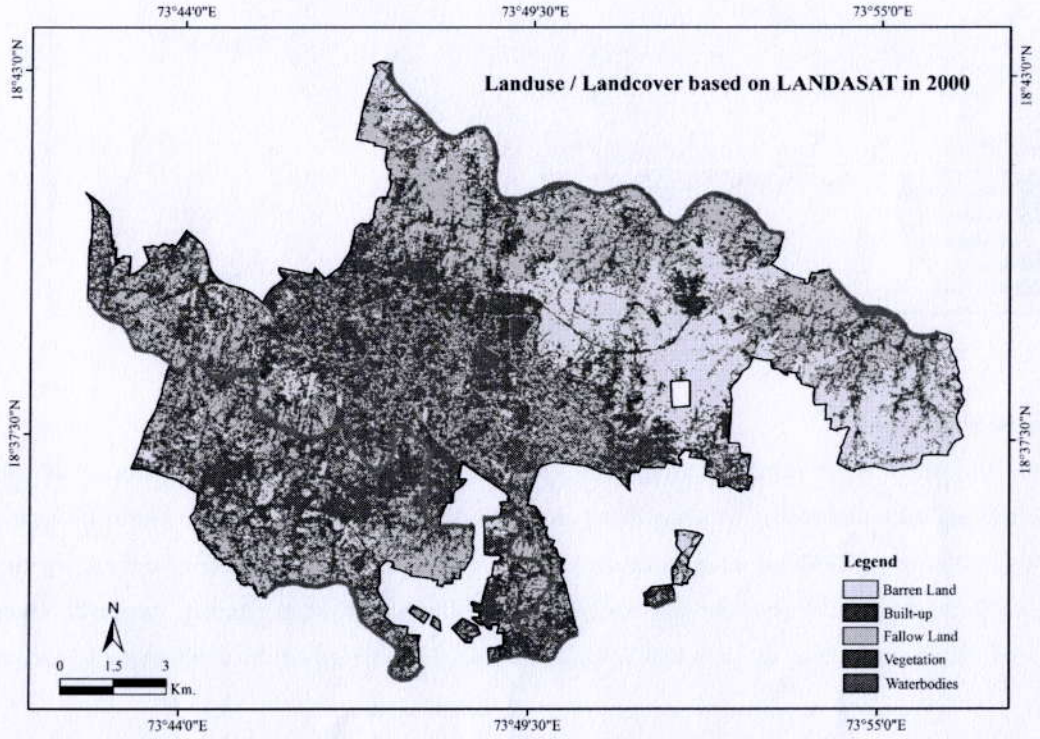


Fig. 2

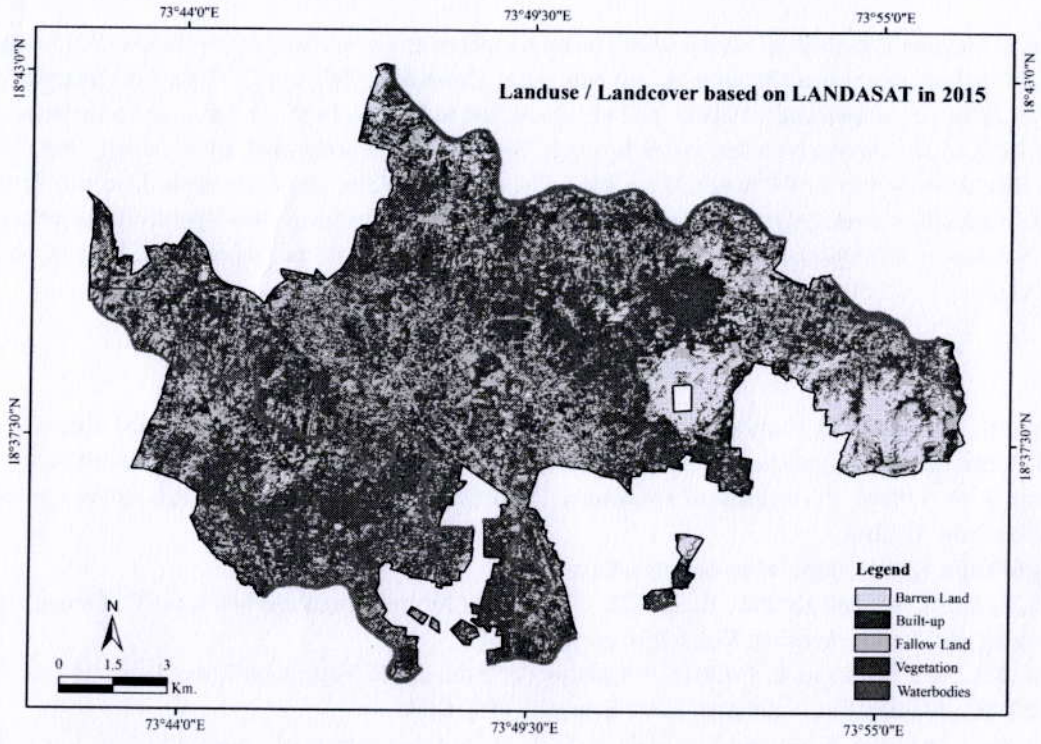

73°44'0"E
73°49'30"E
73°55'0"E
18°43'0"N
18°37'30"N
Landuse / Landcover based on LANDASAT in 2015
Legend
Barren Land
Built-up
Fallow Land
Vegetation
Waterbodies
N
0 1.5 3
Km.

Fig. 3

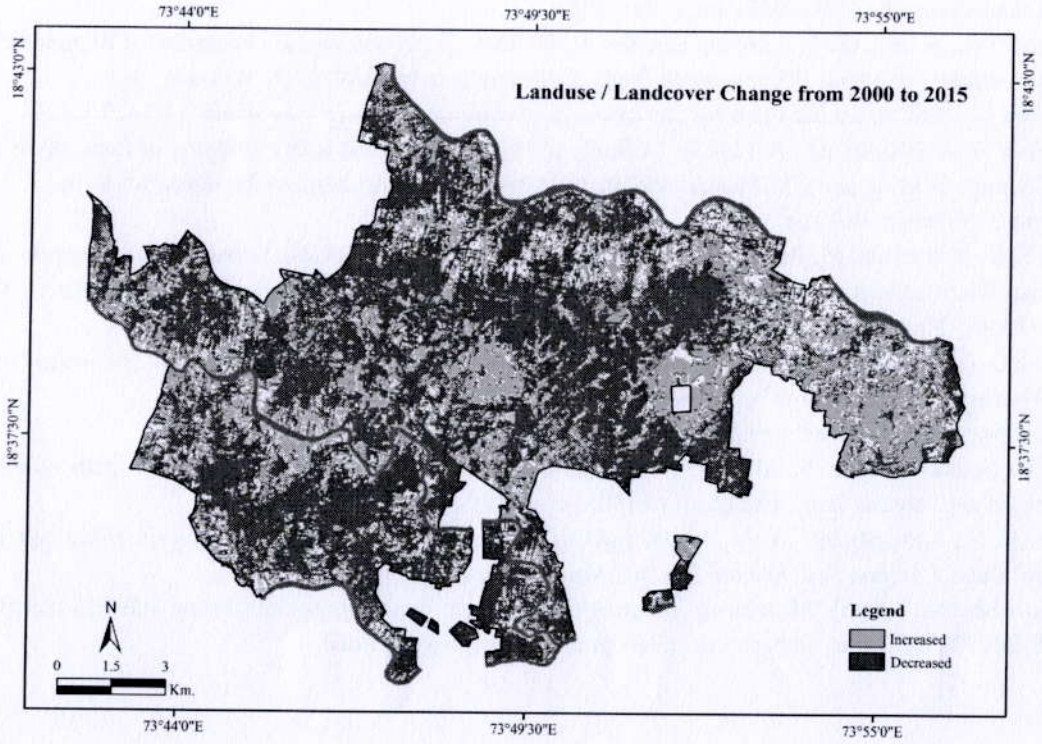

73°44'0"E
73°49'30"E
73°55'0"E
18°43'0"N
18°37'30"N
Landuse / Landcover Change from 2000 to 2015
Legend
Increased
Decreased
N
0 1.5 3
Km.

Fig. 4

Conclusions

The rate of increase is high in all classes which lie on periphery of city centre. In year 2000 to 2015 only Built-up 27.23 % (48.56 sq. km) area was under built-up and now it has grown to 65.84 % (117.42 sq. km.) whereas Fallow land, 13.56 % (24.18 sq. km.), area under Fallow land has decreased to 7.89% (14.08 sq. km.), and Vegetation, shows the from 35.02 % (62.45 sq. km) decreased to 10.79 % (19.25 Sq. Km). The Barren land, shows change from 20.34 % (36.27 sq. km.) area decreased to 11.94 % (21.29 sq. km.) The rate of increase and decrease in land use/ land cover area is very high in suburban areas. Migration of people towards urban area is high as they have tendency of staying in suburban areas because of industrialization and job opportunities. This is one of the important reasons of horizontal growth of study area.

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