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Remote Sensing and GIS Application in Change Detection Study Using Multi Temporal Satellite

Patekar P.R. and Unhale P.L.

School of Earth Science, Solapur University, Solapur, Maharashtra, India

Correspondence should be addressed to Patekar P.R., punamrpatekar@gmail.com

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Abstract Land use/Land cover leads with how people are using the land. Change detection study gives service to analyze temporal data and detect changes which have been taken place in study region. Mapping land use/land cover (LULC) and change detection on GIS platform is an area of interest that has been attracts increasing attention. This paper is an attempt to assess the changes in land use/land cover Basin of Bhima River in Solapur district over a 14 year period. The aim of this study is to detect land use changes between 1991 to 2005 using satellite images of Landsat TM (1991) and ETM+ (2005). Landsat TM (1991) and ETM+ (2005) images were classified by using supervised classification method. In this method maximum likelihood classification algorithm technique is used. In the present study major changes occurred in Agriculture, fallow land and settlement. Population growth increase presser on land resources. The result of present study help to the researcher, environmental developer for understanding to real time condition manage land use more effectively according to the provide needs. Geographical Information System & Remote sensing technique play very important role in land use land cover change detection study. It is a user-friendly and accurate technique for environmental managers.
Keywords *Land Use/Land Cover; Change Detection; GIS; Remote Sensing*

1. Introduction

Land use/land cover deals with physical characteristics of earth surface (Vegetation, Water) and feature created by human activities (settlement). Land use/Land cover leads with how people are using the land (S. Prabaharan, K. Srinivasa Raju, C. Lakshumanan, and M. Ramalingaz, 2010). Change detection study gives service to analyze temporal data and detect changes which have been taken place in study region. Mapping land use/land cover (LULC) and change detection on GIS platform is an area of interest that has been attracts increasing attention.

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2. Aim and Objective

The aim of this study is to assess the changes in land use/land cover Basin of Bhima River in Solapur district over a 14 year period between 1991 to 2005 using satellite data of Landsat TM (1991) and ETM+ (2005).

3. Study Area

Basin of Bhima River in Solapur District of Maharashtra, India.

3.1. Drainage Pattern in Solapur District

The district is drained by numerous streams and rivers. River Bhima, Nira, Man, Sina and Bhogawati are some important rivers in the district. During the rains all these rivers flows full and strong with occasional floods. But after the rains, they rapidly dwindle and in the hot summer season and pools remains only in the deeper hollows, with an occasional flow in the parts between. These rivers play important role in supplying water for drinking, agriculture and industrial purposes. The entire district is drained by the Bhima River.

3.2. Bhima River

The river Bhima is Major River in the district and locally it is called ‘Chandrabhaga’ due to its present shape near holy place Pandharpur. The Bhima is main tributary of Krishna River; she rises at Bhimashankar in Sahyadri Mountain in the Pune district. First she flows towards east and then south-east direction in Pune districts and enters in Solapur district near Jinti village in the Karmala tahasil. & flows to south-east direction. Total length of her course in the district is 288 km. The Nira, Man and Sina are the main tributaries of Bhima. Hence the Bhima valley drains most of part of the district & then meets to Krishna in Karnataka state.

Map of Study Area

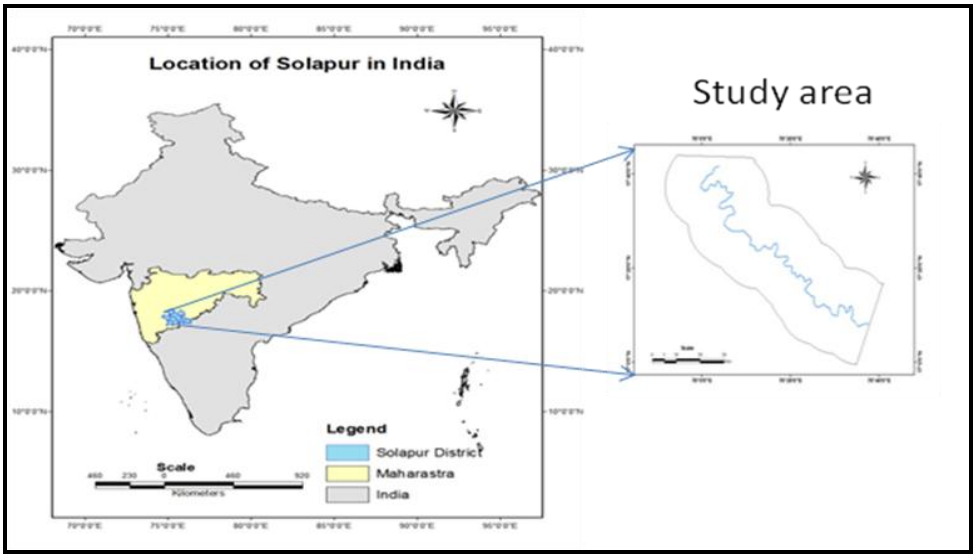

Figure 1: *Map of Study Area*

3.3. Digital Image Processing

The study depended on the use of computer-assisted interpretation of Landsat imageries in ERDAS Imagine. Field survey was performed over the study area using Global Positioning System (GPS). The field survey was conduct to obtain accurate location for training sites and signature generation. Those location points are also used for supervised classification of image and also for accuracy assessment. The Landsat 5 image of year 1991 shows situation which exist 14 year before and recent image of Landsat 7 shows real time situation. Landsat 5 image could not check out through ground truth but the Landsat 7 ETM+ image cross checked against ground truth. Detail of satellite D data is shown in Table 1.

3.4. Data Used

Table 1: *Data Used*

Sr. No.	Data Type	Scale	Source of Data
1	Landsat TM (1991) / ETM+(2005)	30 m resolution	GLCF site
2	GPS	GPS point	Garmin

3.5. Software Used for Present Work

Basically, following software's is used for this project viz;

i. Arc GIS 9.3 – It was used to compliment the display and processing the data.
ii. ERDAS IMAGINE 9.1- It was also used to processing the data.

4. Methodology

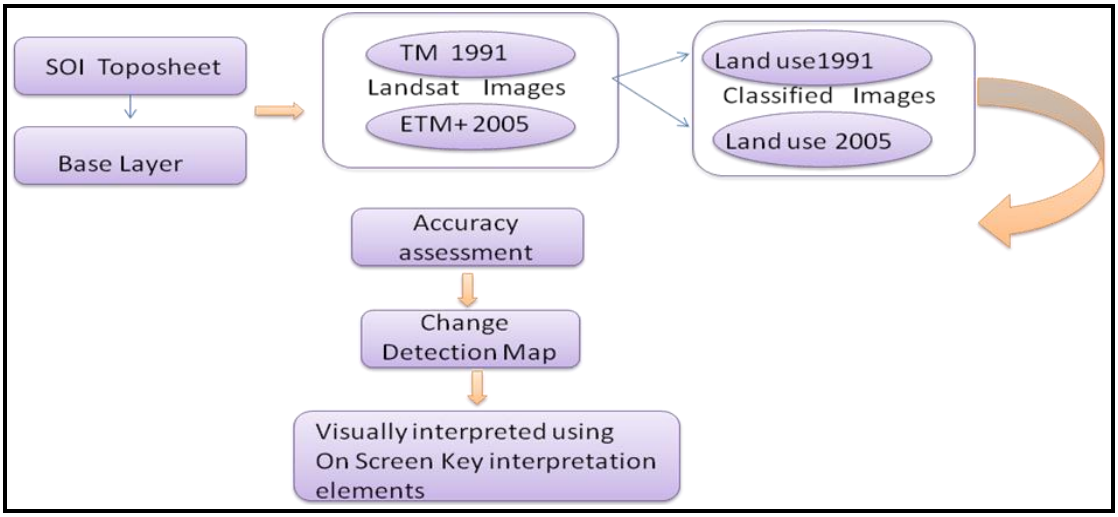

Figure 2: *Methodology*

5. Change Detection

Change detection is the study of change has been taken place in study region in the study period. In general the change detection study includes whether change or not change has occurred (R. Manonmani, G. Mary, and Divya Suganya, 2010).

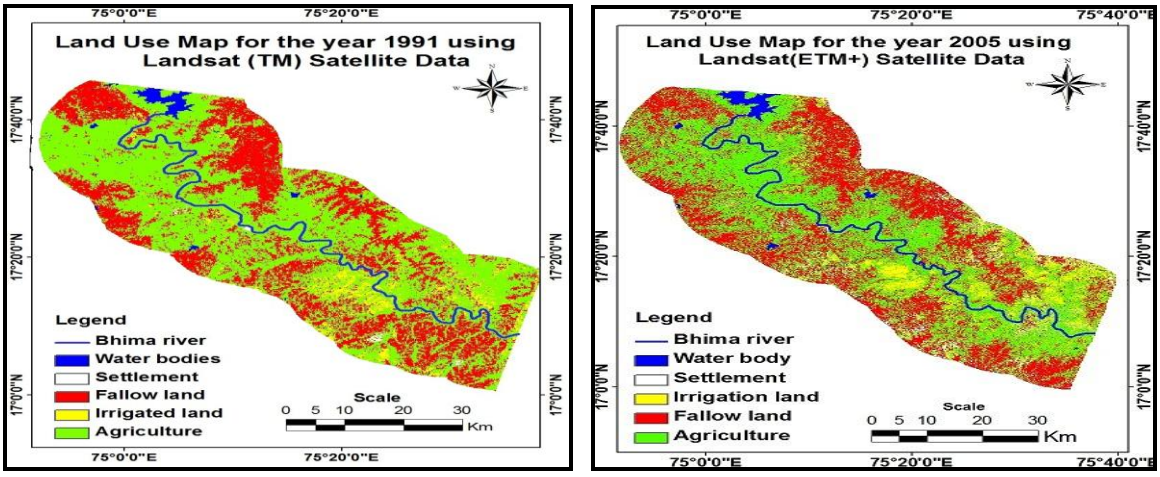

Figure 3: *Change Detection during 1991-2005*

6. Results

The land use categories such as built-up land, agriculture, water body, wasteland and others have been identified and mapped from the Landsat TM and ETM+ of 1991 and 2005. Table 2 shows the Land use/land cover changes and areas of each Land use type in km^2. About 38.44 % of the areas are occupied by agriculture land during 1991 and about 33.01 % areas are occupied by agriculture during 2005. People utilize the land for agricultural purposes. Under utilization, mismanagement could be observed in the field. As a result the yield is not optimum. This is due to shifting of agricultural land to built-up. Increase of about 1.26% of the settlement land during 2005 when compared to 1991. Fallow land is increased about 2.72 % in 2005. The increase in the area under built up lands may lead to a lot of environmental and ecological problems. Agriculture is main source of income in this region but from 1991 to 2005 this classes have been decreased due to new settlement and infrastructure developments. Here proper land use planning is needed. Land use/land cover changes are shown in Figure 3 and Figure 4.

Table 2: *Area under Different Land Use/Land Cover Categories during 1991-2005*

Land use / Land cover Types	1991(Km^2)	Area in (%)	2005 (Km^2)	Area in (%)	Difference
Irrigated land	93.05	20.03 %	95.1	20.47 %	+0.44
Agriculture	178.47	38.44 %	153.30	33.01 %	-5.43
Water bodies	49.09	10.58 %	49.09	10.58 %	0
Fallow land	102.95	22.16 %	115.54	25.89 %	+2.72
Settlement	40.81	8.79 %	51.34	10.05 %	+2.26
Total	464.37	100%	464.37	100%	

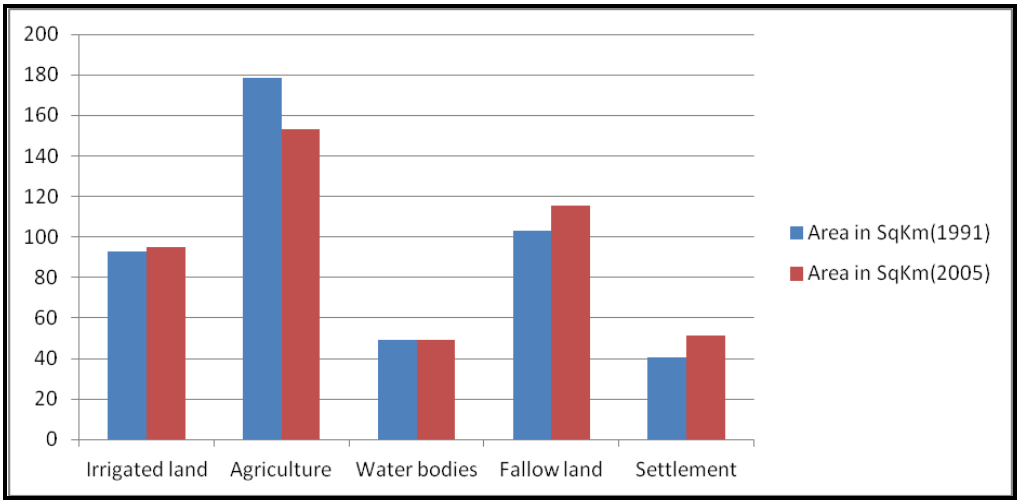

Figure 4: *Area under Different Land Use/Land Cover Categories during 1991-2005*

7. Conclusion

Remote Sensing and Geographical Information System is very effective for Land use/Land cover change detection study. Remote sensing data like Landsat TM & ETM+ provides accurate data for land use/land cover change detection and analysis. The overall accuracy of this study found 81 % in the process of accuracy assessment. The land use/land cover occurred changing day by day due to the forces of utilization of potential land, population growth during the study period of 14 years.

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