Land Use / Land Cover Change Detection in a part of Ramganga River Basin, at Bareilly District, Uttar Pradesh, India

S.S.Tripathi[1], R.K.Isaac[2]

[1]Reseach Scholar (Soil & water conservation engineering), VSAE, SHIATS, Allahabad. U.P. India.
[2]Professor, Soil Water Land Engineering and Management, VSAE, SHIATS, Allahabad. U.P. India.

Abstract *–The paper deals with the status of the land use/land cover change taken place in a part of Ramganga River Basin, at Bareilly district, Uttar Pradesh, India, by using remote sensing satellite data. The present study area is confined to latitude 28°10′ to 28^{0}54′ North and longitude 78°58′ to 78^{o}58′ East, covering an area of 4120 km^2. The satellite images of 1979 and 2009 have been obtained from global land cover facility (GLCF) and examined by unsupervised classification method. The general classification level has been adopted. The identified classes include Settlements, Croplands, Vegetation/Plantations, Water Bodies, and Waste Land. The result shows increasing trend of crop land and built up area and decreasing trend of vegetation and Plantation land.*

Keyword – Land use/ Land cover, Change Detection, Remote Sensing, G.I.S., Ramganga River Basin.

I. INTRODUCTION

The land use land cover change refers to the man made modifications afflicted upon the earth surface like riparian forest is converted to range lands or agricultural fields; agricultural fields are converted to build up area for residential or industrial purpose. Though such alteration on the land surface was being done regularly by the humans for their food and other essential needs for centuries, but it has been very intense during the recent past. It has been observed that the rate of conversion was significant but slow during 1700-1850. However after 1850, the pace of conversion quickened and particularly from 1990 onwards the expansion of croplands was very rapid in many parts of the world. By the final quarter of the twentieth century, the transformation of the Earth's land had become staggering in scale (Ramankutty and Foley 1999; and Tian et. al. (2014). The rapid population growth along with economic development, urbanization and industrialization create tremendous pressure on the limited natural resource base in a country. The land use/ land cover change information has an important role to play at local and regional planning (Kumar et al 2014).The planning and management task is hampered due to insufficient information on rates of land-use/ land-cover change. The land use/ land cover changes occur naturally in a progressive and gradual way, however sometimes it may be rapid and abrupt due to anthropogenic activities. Satellite data of better resolution at different time interval help in analysing the rate of changes as well as the causal factor or drivers of changes (Kumar et al 2014). The land use/land cover resources are the bases for various development activities on the earth. The land use/land cover is one of the most important parameter to have meaningful plan for land resource management, such as development of cities, available water resources, mining activities, Agriculture, pasture, and environmental activities. It also enables the anticipation of the problems that may accompany with change in land use. Remote sensing and geographic information system, the two mutually compatible technologies are used more effectively in natural resource management. The study area, Bareilly district which is part of Western Uttar Pradesh has also experienced rapid economic growth, in a fashion similar to Haryana and Punjab, due to the success of the Green Revolution. This has resulted into rapid changes in the Land use Land cover pattern in the study area district Bareilly. The researchers and policy makers have to strike a balance in the use of natural resources, keeping in mind the need for their conservation of sustainable development and food and livelihood security. The main objective of this paper is to detect and quantify the LU/LC in the study area, Bareilly district, from 1979 to 2009 using satellite imagery and topographic map so that it can be used in planning future developmental activities in the study area in a sustainable way.

II. STUDY AREA

The Bareilly district is located in the north western part of U.P. and lies between latitude 28^{0}10' and 28^{0}54' North and longitude 78^{0}58' and 79^{0}47' East falling in the Survey

of India (SOI) toposheet no. 53P. Its maximum length from north to south is about 96 Km and breadth from east to west is about 75 Km. The soil is fertile and highly cultivated. The Ramganga River, which receives most of the hill torrents of the Kumaun Mountains through its tributaries flows through this district. The Deoha is another drainage artery and receives many minor streams. For the administrative convenience the Bareilly district, has been divided into six Tehsils, which are (1) Bareilly Sadar, (2) Baheri, (3) Aonla, (4) Nawabganj, (5) Faridpur and (6) Mirganj. The geographical area is around 4,120 km^2. The main economic activity is agriculture. The main crops grown are: Wheat, Sugarcane, Rice, Mentha, oilseeds, vegetables etc.

III. DATA USED AND METHODOLOGY

Data Used:

The following satellite data and Survey of Indian Top sheet are used in this analysis.

Table. 1. Detail of images and Survey of India Map acquired and used.

Sl. No.	Image ID	WRS:P/R	Acquisition Date	Data set	Producer	Type	Location	Remarks
1	228-888	1:156/040	26-10-1979	MSS	USGS	Geo TIFF	India-Nepal	4 images
2	291-747	2:145/040	18-10-2009	TM	USGS	Geo TIFF	India-Nepal	7 images
3	Survey of India (SOI) toposheet No. 53P							

Methodology:

For the present study, the satellite images of the study area acquired for the two epoch; 1979 and 2009 from Global Land Cover Facility (GLFC), and Toposheet No. 53P as detailed in the table. 1, have been used. The topographic map of district Bareilly a part of Ramganga River Basin on 1:50,000 scale was georeferenced using Erdas Imagine version14 Software. The geographical boundary of the district Bareilly as it stood in 1979 was Vectorized from the survey of India topographic map. The satellite Imagery of 1979 and 2009 hiving resolution of 30 m were used for land use/cover classification. These data sets were imported in ERDAS Imagine version14 Satellite image processing software to create a false colour composite (FCC). The layer stack option in image interpreter tool box was used to generate FCCs for the study areas. Unsupervised classification used for classified images for the study area. And finally recoding method is applied for merging all classes in single one class.

IV. RESULTS AND DISCUSSION

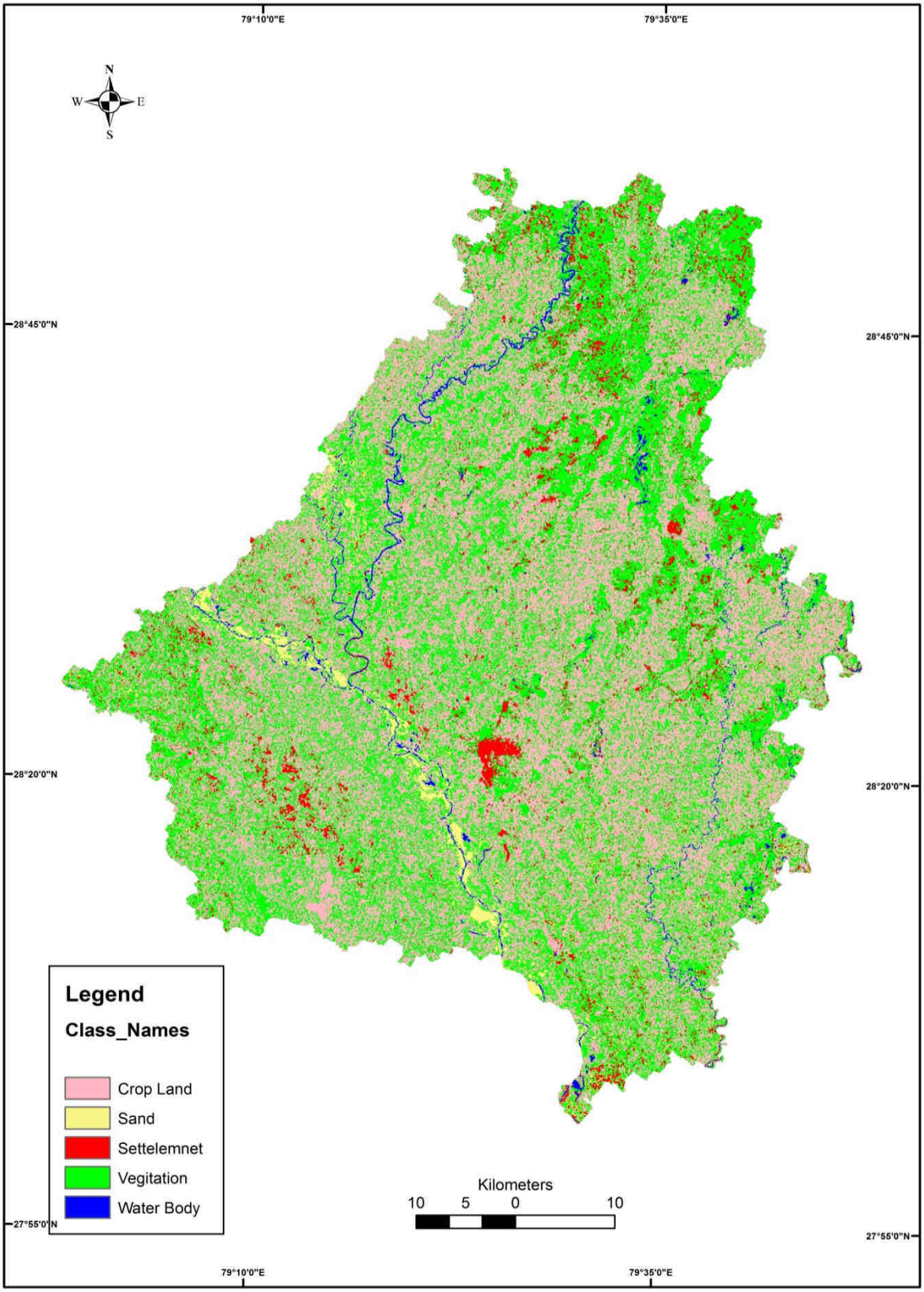

Fig.1: Land use/ Land cover map of the study area (Bareilly) – Year 1979

-4-

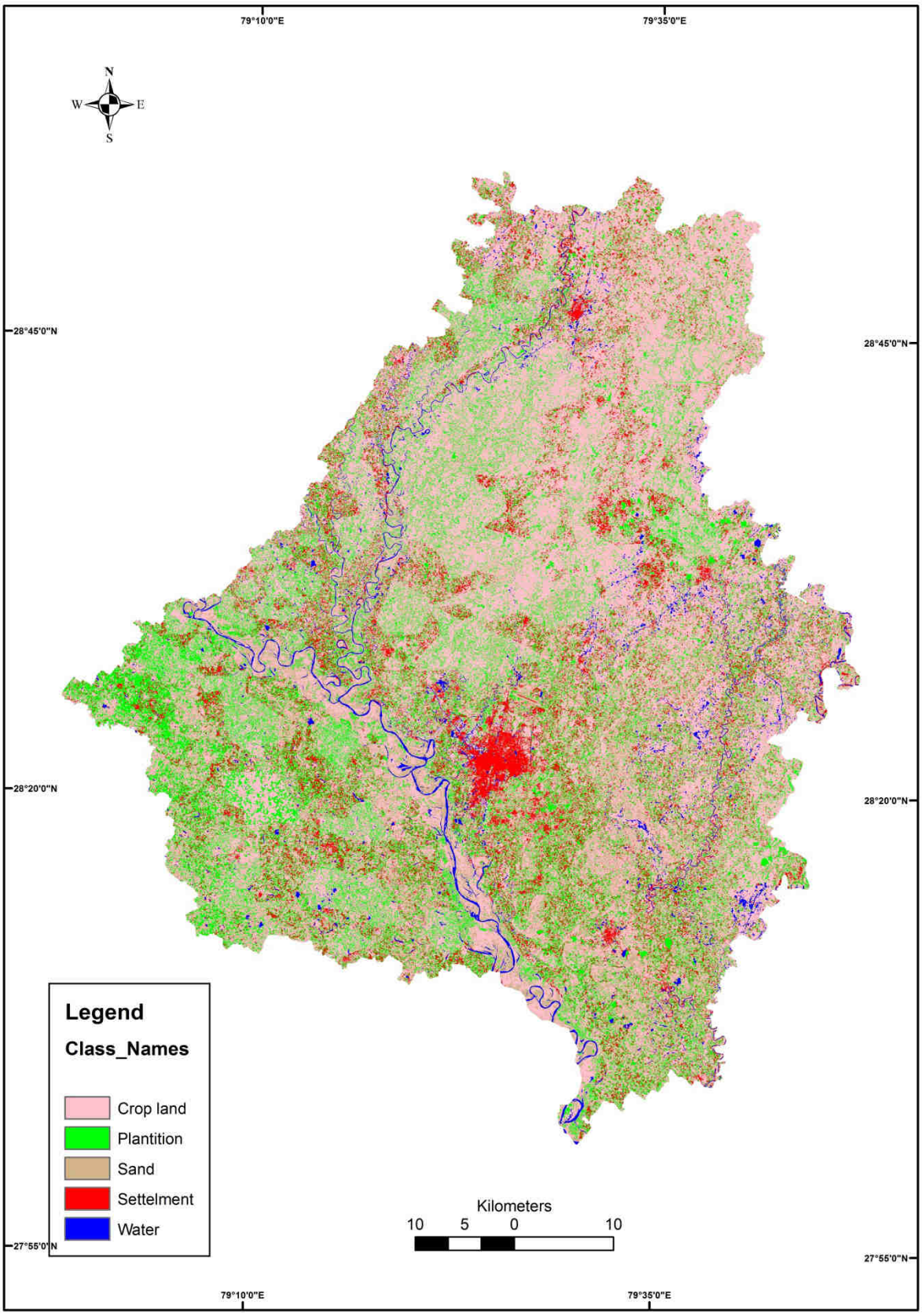

Fig.2: Land use/ Land cover map of the study area (Bareilly) - Year 2009

Table: 2. Land use Land cover analysis of the study area.

Category	1979		2009	
	Area (ha)	Area (%)	Area (ha)	Area (%)
(1)	(2)	(3)	(4)	(5)
Plantation/Vegetation/Forest Cover	181280	44	70040	17
Crop Land	181280	44	226600	55
Settlement	24720	6	70040	17
Waste Land	20600	5	28840	7
Water Body	4120	1	16480	4
Total	412000	100	412000	100

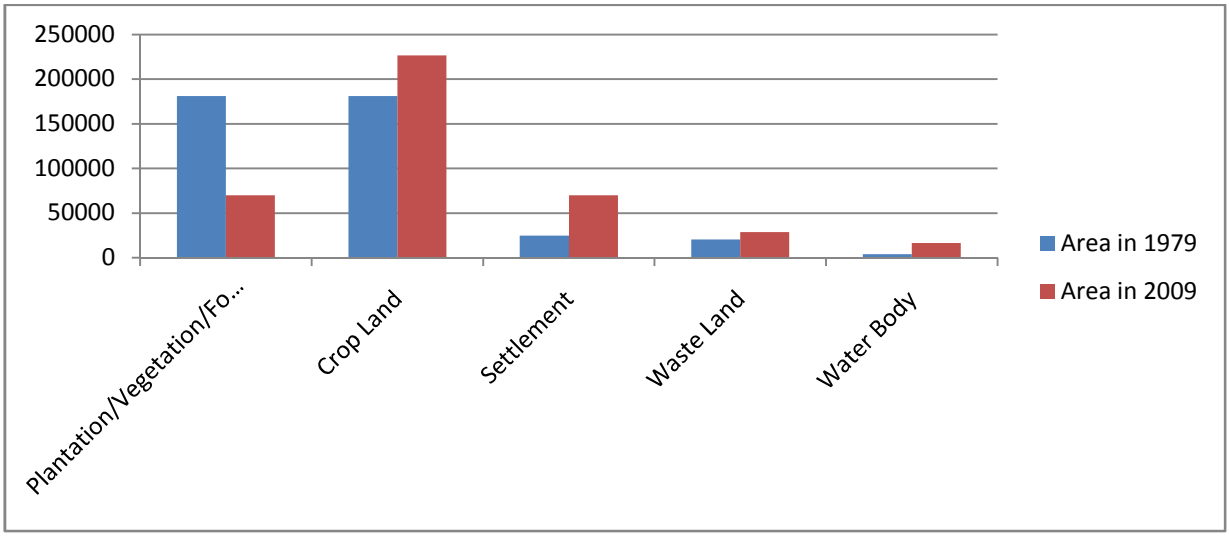

Fig. 3: Graph depicting Land use Land cover area of 1977 1nd 2009.

The Land use Land cover analyses as shown in table 2, and Figure 1, 2, and 3 above, indicate that in the year 1979, a major portion of the study area (44%) is under vegetation/plantation/forest cover. Similarly an equal portion (44%) of the study area is under agriculture crop land. The area under waste land is about 5% of the total geographical area. The area under settlements (built-up/Roads etc) is merely 6% of the total geographical area. But after passage of about 30 years i.e. in 2009, the composition of land use land cover has changed significantly. Now the area under vegetation/plantation/forest cover has decreased from 44% to mere 17%. This reduction in the vegetation/plantation/forest cover area has been the result of conversion of such area into crop land, Settlements, and waste land. Consequently, the area under Crop land has increased from 44% to 55%, Settlements from mere 6% to 17% and Waste land from 5% to 7%.

V. CONCLUSION

The study of remotely sensed data showed that the study area Bareilly district has undergone significant change in land use land cover over last 30 years (Between 1979-2009). Classified image of year 1979 distinctively showed rich vegetation cover closely to half of the total area. But it is found converted mostly into cropland and built-up/settlement area with the passage of 30 years i.e. by year 2009. The above changes in the land use land cover has been mainly due demand of more food for growing population and need for the development of infrastructure. However, conversion of plantation/vegetation lant to agriculture crop land and Agriculture crop land into built-up/settlement area need to be monitored and regulated judiciously for the preservation of natural resources and sustainability of the ecosystem.

REFERENCES

[1] Ramankutty Navin and Foley Jonathan 1999: Estimating historical changes in global land cover: croplands from 1700 to 1992: Global Bio-geochemical cycles, vol. 13, no 4, pages 997- 1027, December 1999.

[2] Tian Hanqin, Banger Kamaljit, Bo Tao, and Dadhwal Vinay K; 2014: History of land use in

India during 1880–2010: Large-scale land transformations reconstructed from satellite data and historical archives: Global and Planetary change, volume 121, October ,2014, page 78-88, www.elsevier.com/locate/gloplacha.

[3] Dilip Kumar, Vinod Bhuria, Ajay Kumar and Priyanshi Dixit, 2014: Evaluation of Land use/Land cover change detection in a part of Mandakini River Basin, Chitrakoot District, Uttar Pradesh, India. Asian Journal of Multidisciplinary studies, vol. 2, issue 12. December 2014.